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FM 1-80

DEPARTMENT OF THE ARMY FIELD MANUAL

AERIAL OBSERVER TRAINING



HEADQUARTERS, DEPARTMENT OF THE ARMY

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FIELD MANUAL

No. 1-80

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AERIAL OBSERVER TRAINING

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CHAPTER 1

INTRODUCTION

1. Purpose

This manual provides guidance to commanders and staffs who are directly concerned with the instruction and conduct of aerial observer training.

2. Scope

a. This manual describes aerial observer techniques and training procedures to qualify selected personnel to observe from Army aircraft. Discussion is focused on direct observation by aerial observers.

b. The material contained herein is applicable to nuclear and nonnuclear warfare.

c. Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Comments should be keyed to the specific page, paragraph and line of the text in which change is recommended. Reason should be provided for each comment to insure understanding and complete evaluation. Comments should be forwarded directly to the Commandant, United States Army Aviation School, Fort Rucker, Ala.

3. Objective and Missions of Aerial Observation

a. The objective of aerial observation is to provide timely information to the supported commander through missions performed by Army aviation employing aerial observers.

b. Aerial observation is employed in—

- (1) Aerial surveillance.
- (2) Aerial reconnaissance.
- (3) Special missions.

CHAPTER 2

BASIC PRINCIPLES

Section I. GENERAL

4. Tactical Application of Aerial Observation

a. Army aviation is employed by the commander to extend his observation capabilities over his area of influence and interest. Observation employing aerial and ground means gives a more complete coverage of the commander's areas of influence and interest than either aerial or ground observation alone.

b. Gathering information is not the sole function performed by Army aviation; it is only one of several of its support roles. At times, the commander will have to sacrifice extended aerial coverage of the battlefield for higher priority aviation missions. He will assign priorities to those aerial tasks that best serve his command in a particular tactical situation.

5. Capabilities

Aerial observation is a primary capability of Army aviation. Properly employed, it—

a. Increases the combat effectiveness of the supported ground units.

b. Provides greater observation coverage and, therefore, greater security within the commander's area of influence and interest.

c. Avoids the obstacles and other restrictions normally encountered in ground observation and reconnaissance.

d. Accelerates the accumulation, reporting, and dissemination of information.

6. Limitations

Major factors that adversely affect the employment of Army aircraft and the accuracy and completeness of the information obtained by aviator-observer teams are—

a. Weather. Weather conditions which produce poor visibility may affect accuracy and completeness of information or prevent its collection by direct means. Use of indirect observation means such as infrared and electronic devices can lessen the effect of this limitation, provided the aircraft can be operated along the desired flight route.

b. Air Defenses. The enemy's air defenses may deny access to certain areas.

c. Loss of Secrecy. Increased aerial activity over a specific area may indicate to the enemy the intentions of the ground commander. Proper employment of counterintelligence measures and careful cover and deception planning of aviation missions will lessen the effect of this limitation.

d. Terrain. The primary limitation of terrain involves those areas having dense vegetation, such as jungle areas, or similar natural restrictions to visual observation. Natural restrictions may have similar effects on the various indirect observation means.

e. Night. Night restricts direct observation but has less effect on indirect observation.

Section II. ARMY AIRCRAFT USED FOR AERIAL OBSERVATION

7. General

Army aviators are familiar with the duties and requirements of aerial observers and the type aircraft best suited for aerial observation. The aircraft shown in this section are those most suitable for aerial observation, although all Army aircraft have an aerial observation capability of varying degree.

8. Airplanes

a. Light Observation. The light observation airplane (L-19) (fig. 1) is the Army's primary observation aircraft. It has a visual and photographic capability.

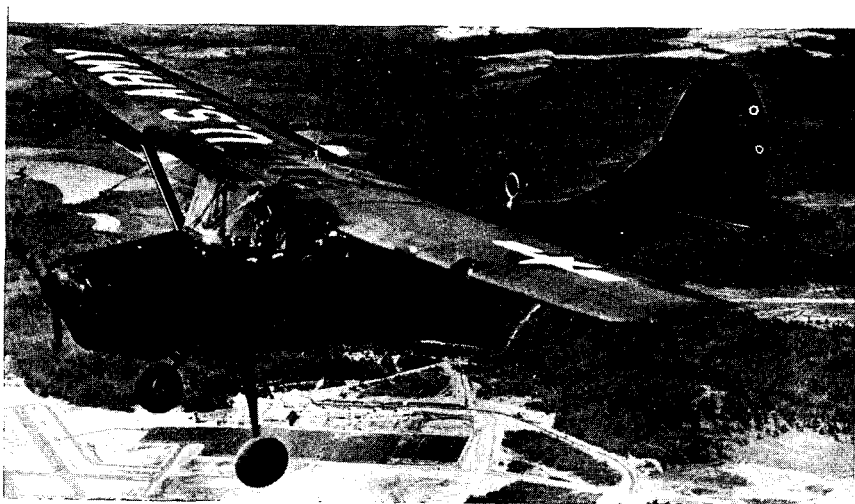


Figure 1. The L-19 Bird Dog.

b. Medium Observation. The medium observation airplane (AO-1) (fig. 2) has an all-weather, visual, photographic, and electronic* observation capability for deep penetration of missions over enemy-held areas. The L-20 utility airplane (fig. 3) is being used as an interim medium observation aircraft in certain aviation units.

9. Helicopters

a. Observation. Observation helicopters (H-13 and H-23) (figs. 4 and 5) are employed for visual observation missions of short duration requiring frequent landings in restricted areas and/or slow airspeeds.

b. Utility. The utility helicopter (HU-1) (fig. 6) has a multi-purpose capability. It may be employed for observation missions that require a range and speed capability greater than that of the observation helicopter.

Section III. COMMAND AND STAFF RESPONSIBILITIES FOR AERIAL OBSERVATION

10. Intelligence Officer, G2(S2)

The G2(S2) performs the staff responsibilities prescribed in chapter 3, FM 101-5.

11. G2(S2) Air

The G2(S2) Air performs the functions prescribed in TC 101-2.

12. Commanding Officers, Supported Ground Forces

Commanders of supported ground units are responsible for furnishing qualified personnel as aerial observers.

13. Army Aviation Staff Officer

The Army aviation staff officer performs the staff responsibilities prescribed in chapter 3, FM 101-5 and in TC 101-2.

14. Commanding Officer, Army Aviation Unit

The commanding officer of an aviation unit is responsible for—

a. Employment of available organic means in the execution of aviation missions assigned to his command.

b. Training aerial observers.

* B and C models only.

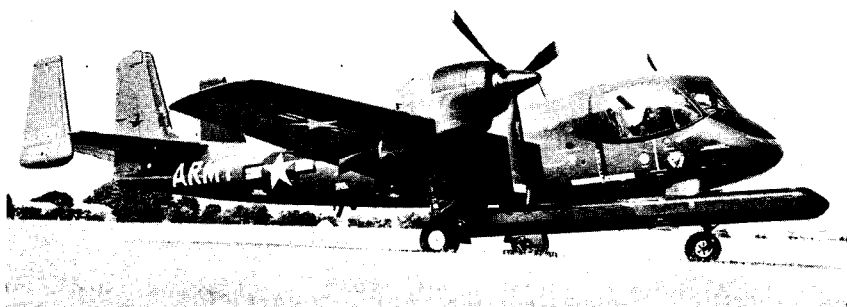


Figure 2. The AO-1 Mohawk.

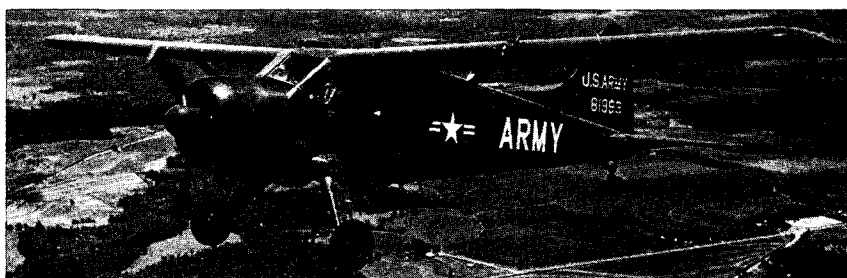


Figure 3. The L-20 Beaver.

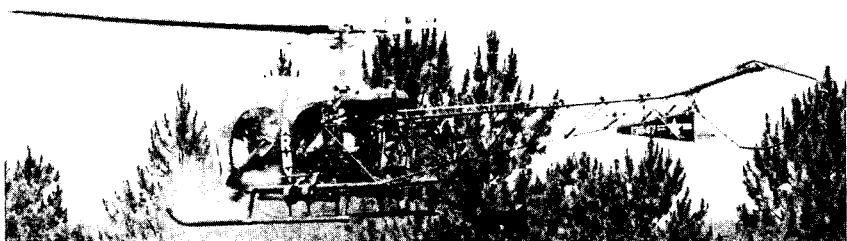


Figure 4. The H-13 Sioux.

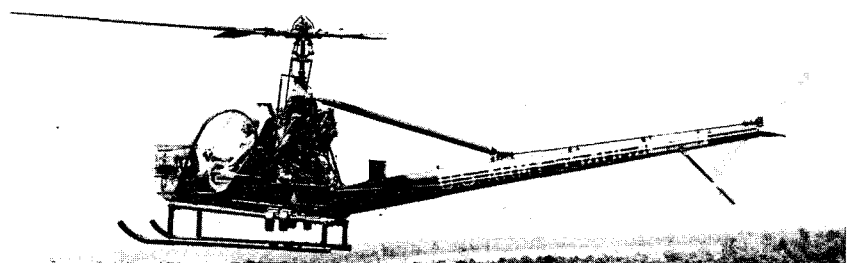


Figure 5. The H-23 Raven.

15. Operations Officer, Army Aviation Unit

The operations officer of the aviation unit is responsible to the unit commander for—

- a. Supervising the aviation unit operations section.
- b. Processing, assigning, and planning specific flight missions.

16. Aviator-Observer Teams

Aviation-observer teams—

- a. Must have a thorough understanding of the mission.
- b. Plan the mission.
- c. Supervise preparation of the equipment.
- d. Prepare and file the flight plan for the mission.
- e. Execute the mission.
- f. Prepare mission data for debriefing.

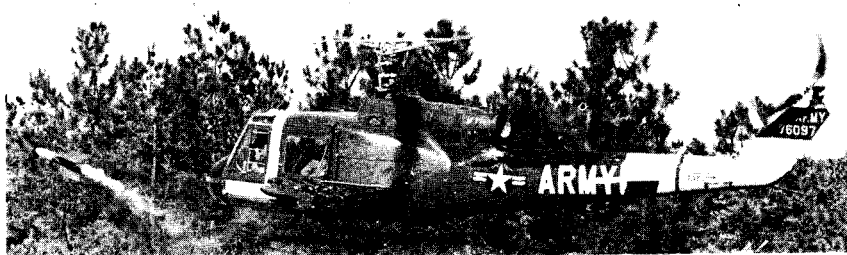


Figure 6. The HU-1 Iroquois.

CHAPTER 3

AERIAL OBSERVATION MISSIONS

Section I. GENERAL

17. Concept of Employment

Aviation-observer teams will fly missions mainly in the support of infantry, armored, and artillery units. Specific missions are categorized as surveillance, reconnaissance, or special. During a single flight, aviator-observer teams may be called upon to change from one mission to another, or to perform more than one type of mission category. For example, an aviator-observer team on a surveillance mission may be diverted to confirm a suspected target, thus changing the mission to one of reconnaissance; or the aviator-observer team on a reconnaissance mission may be called upon to perform a special mission of radiological survey. Adjustment of fire and target acquisition are inherent in all missions involving aerial observation.

18. Requirements

a. Aviator-observer teams performing aerial observation must be capable of providing—

- (1) Timely response to the requirements of the combat intelligence system.
- (2) Complete and accurate information in the degree of detail requested.

b. Missions involving aerial observation are—

- (1) Flown at the altitude(s) necessary for mission accomplishment.
- (2) Planned to assure minimum loss of efficiency by the aviator-observer team due to fatigue. (After 2 hours of continuous observation, the observer's capability to provide accurate and complete information depreciates rapidly.)

c. The aviator-observer teams will be required to detect, identify, estimate size, and determine location, disposition, and activity of targets. As required by the mission, the team must rapidly record or report all significant observations while the aircraft is operating at varying attitudes, groundspeeds, and altitudes. Em-

phasis is placed on *speed, accuracy, and completeness* of information.

- (1) *Detection.* Targets must be detected under conditions of excellent concealment and great dispersion to include the temporary or highly mobile targets.
- (2) *Identification.* Targets must be accurately identified and promptly reported to permit valid assessment of the situation and application of appropriate counter-measures.
- (3) *Strength estimation.* Accurate reports of strength or size provide additional information about the capabilities and composition of enemy forces. The dispersion on the battlefield will result in an increased number of target groups. The elevated position of the aerial observer will enhance his capability to estimate the strength of these groups.
- (4) *Target location.* Exact location of targets is essential, particularly if the target is to be engaged by unobserved fire. Targets to be attacked by divisional fires must be located within tolerances of plus or minus 50 meters.
- (5) *Disposition and activity.* Accurate and complete reports on target disposition and activity provide guidance in determining enemy composition and capabilities and locations of highly mobile enemy targets.

19. Aerial Surveillance Missions

Aerial surveillance involves the systematic and continuous observation of specific air, surface, or subsurface areas by visual, electronic, photographic, or other means employing an aircraft as the aerial platform. Aerial surveillance missions provide the supported commander with current information by keeping a systematic watch over a well-defined area for the purpose of detecting, identifying, locating, and reporting any information of military value. Surveillance of enemy-held areas normally extends from the forward edge of the battle area to the limit of the observation means available to the commander. Factors influencing surveillance areas are visibility, terrain, natural or manmade concealment, enemy air defense capabilities (both aircraft and ground weapons), and aircraft combat radii of action.

20. Aerial Reconnaissance Missions

Aerial reconnaissance missions are flown to gather specific information of military value. This information normally pertains to the enemy, to include his strength, disposition, activities, and terrain. Areas to be reconnoitered must be thoroughly searched

and boundaries assigned. Factors influencing the size of areas to be searched on an aerial reconnaissance mission are visibility, terrain, natural or manmade concealment, time available, enemy air defense capability (both aircraft and ground weapons), nature of information desired, and aircraft combat radii of action. The types of reconnaissance missions are discussed below.

a. Area search is used to observe areas. This type of reconnaissance is suited to sparsely populated or open country and is conducted at specified intervals for a specified period of time. Depending upon the number and capability of aircraft used, type of terrain, and information sought, search areas vary in size from very small areas to 2,000 square miles.

b. Specific search is used to observe a limited number of points for specific information. It is suited to densely populated areas and may supplement area search missions. Normally, this mission is not flown on a regular schedule.

c. Route reconnaissance is observation along lines of communications such as roads, railroads, and waterways to determine conditions of the route of enemy activity. It is carried out on a point-to-point or town-to-town basis over main transportation routes and may pass through several search areas. Route reconnaissance supplements area search.

d. Artillery adjustment is the adjustment of mortar and field artillery to include ground-to-ground missiles, and naval gunfire. (For detailed explanation, see PART THREE, FM 6-40.)

21. Special Aerial Observation Missions

Special aerial observation missions include—

a. Column Control. Aerial column control is used to—

- (1) Provide security for and control of mass troop or vehicular movements by visual and radio contact with the column.
- (2) Support foot or mechanized patrols to enable rapid movement over unfamiliar and unmapped terrain.
- (3) Minimize the danger of surprise by the enemy.

b. CBR Survey. A mission flown to survey the presence and intensity of radiological contamination in a specific area.

c. Camouflage Inspection. Observation from the air of friendly units to determine the condition and effectiveness of camouflage.

d. Contact Reconnaissance. An aerial mission to locate friendly units which are isolated or cut off from the main force, e.g., a long range patrol out of contact with higher headquarters.

e. Artillery and Topographical Survey. See FM 1-100.

f. Additional Aerial Missions. Any aerial mission other than those listed above which assists the commander in accomplishing his overall mission.

22. Techniques and Means

a. The factors listed below must be considered in determining the techniques and means to be employed to accomplish effective aerial observation.

- (1) Type mission.
- (2) Capabilities and availability of aircraft, equipment, and personnel.
- (3) Time available.
- (4) Enemy location and air defense capabilities.
- (5) Terrain and weather.

b. Based on the considerations in a above, a variety of procedures will be used to initiate the mission.

- (1) *Assignment of mission priorities.* The commander establishes priorities to insure immediate response to his most critical aviation requirements. Priorities may be modified as changing conditions require.
- (2) *Assignment of missions.* Within the commander's priorities, missions are assigned based on the capabilities of aircraft, equipment, and aviator-observer teams. This procedure enhances the possibility of complete, accurate, timely, and detailed information.
- (3) *Assignment of type and number of aircraft.* The type and number of aircraft used for aerial observation depends upon the mission, weather, and availability of aircraft.
- (4) *Selection of means.* Missions may be completed by—
 - (a) An aviator-observer team,
 - (b) Aircraft or drone system equipped with photographic or electronic sensory devices, or
 - (c) The use of a combination of visual, photographic, and electronic sensory equipment.
- (5) *Designation of flight procedures.* The aviator-observer team may vary the flight path (when it is not assigned) to take advantage of cover and concealment, to gain the element of surprise, and to evade enemy fire. Speed and altitude can be varied commensurate with the team's ability to obtain the information in the detail desired.

Section II. BRIEFING, PREFLIGHT PLANNING, DEBRIEFING

23. General

a. The aviator-observer team is a valuable aid to the intelligence collection effort. The team must be familiar with the

mission to be flown, must adequately plan and prepare for the flight portion of the mission, and must use prescribed methods for reporting mission data.

b. For missions involving aerial observation, the aviator-observer team will—

- (1) Receive a briefing.
- (2) Plan and prepare for the mission.
- (3) Execute the mission.
- (4) Receive a debriefing.

24. Briefing

The aviator-observer team will frequently execute missions involving flight over more than one unit of battle group size; e.g., a surveillance mission, originating at division level, but flown over more than one battle group's area of influence. To insure thorough understanding of assigned missions, the aviator-observer team receives general and preflight briefings. At the airfield, the assistant G2/S2 Air (or his representative) conducts the intelligence portion of the briefing. The flight operations officer conducts that portion of the briefing pertaining to aviation.

a. A general briefing is given daily to all aviator-observer teams in which pertinent information is presented concerning the next 24 hours of the tactical operation. This briefing shortens and simplifies preflight briefings during the subsequent 24 hours.

b. The aviator-observer team receives a preflight briefing in conjunction with mission assignment. The preflight briefing is an informal discussion which gives the aviator and observer all current available information pertaining to the mission.

c. The general and preflight briefings are conducted using the "Guide to Aviation Briefing" which is patterned after the 5-paragraph operation order. A sample guide is shown below.

A GUIDE TO AVIATION BRIEFING

1. Situation

- a. **Enemy Forces:** Identification, location, activity, strength, terrain, weather.
- b. **Friendly Forces:** Requirements of next higher unit; location and planned actions of adjacent units; location

and planned actions of supported unit; fire support available; missions and routes of other aircraft.

c. Attachments and detachments.

2. Mission (Who, What, When, Where, and Why, and as much of the "How" as the situation requires.)

3. Execution

a. Concept of operation.

b. Specific duties of subordinate elements.

(Use as many additional paragraphs as required to provide detailed instructions to subordinate units.)

c. Coordinating instructions.

(1) Flight plan: Routes, formations, checkpoints (initial point, aerial checkpoint, release point), zones.

(2) Loading information.

(3) Landing information.

(4) Location of friendly airfields and alternate fields (place in par. 1.b. if pertains to higher or adjacent unit airfields).

(5) Air traffic regulation and identification.

(6) Artillery support—Reference lines, preplanned fire, registrations, concentrations, barrages.

(7) Preplanned nuclear fires.

(8) Ground units at objective (methods of contact, recognition).

(9) Pickup point for downed crews and passengers.

(10) Reporting.

4. Administration and Logistics

a. POL requirements.

b. Maintenance.

c. Special equipment.

d. Evacuation.

e. Rations.

5. Command and Signal

a. Signal.

(1) Air-ground signals.

(2) SOL.

(a) Frequencies and call signs.

(b) Codes—Authentication, map, and operational.

b. Command.

(1) Chain of Command.

(2) Location of the commander.

25. Preflight Planning

a. Map and Photo Selection. Only those maps needed for the mission should be carried by the aviator-observer team. Maps and photos should be current and of the proper scale to facilitate navigation by the aviator and the accurate recording of information by the observer. For navigation, medium scale maps (1:100,000) will assist the aviator in flying from the airfields to the mission area; for observation, tactical scale maps (1:50,000) will aid the observer in accurately identifying and locating prominent terrain features by coordinates. The scale of an aerial photo should not be smaller than 1:20,000 and, depending upon the detail desired, may be as large as 1:5,000.

b. Terrain Evaluation. Preliminary analysis of the terrain to be covered is made from maps and photos, past experience of the aviator and observer, viewpoints of other personnel with experience in the area, and recorded information from previous missions. Areas known to contain enemy positions or activities are marked on the map or photo. Key terrain features, woods, and defilade areas are marked for close observation as possible locations for enemy strongpoints, artillery positions, assembly areas, supply dumps, etc. Guiding factors in determining probable locations of enemy positions or activities in the area of influence (battalion, squadron, regiment, and brigade) include the following:

- (1) Strongpoints and observation posts can be expected in any area where the terrain offers a decisive advantage to the holder.
- (2) Artillery positions are normally located in defilade.
- (3) Assembly areas are usually in wooded areas or other areas offering cover and concealment.
- (4) Supply installations have an accessible road net and, when possible, are located out of range of friendly artillery.
- (5) Road blocks can be expected at narrow points along the routes of advance where bypasses are difficult or impossible to construct.
- (6) Command posts are normally located near a good road net, in defilade, and in an area containing good natural concealment. Presence of vehicles, temporary troop shelters, and a concentration of communications antennas usually indicates location of unit command posts.

c. Preparation of a Flight Plan. When preparing a flight plan, the aviator-observer team conducts a detailed map and photo

study; selects primary and alternate flight paths, altitudes, and checkpoints; memorizes prominent terrain features; and makes notes as necessary to assist in accurate orientation and location. In addition, the following factors must be considered:

- (1) *Type mission.* The flight path must coincide with the assigned task; i.e., if the mission is area search, the flight plan must permit the observer to view the entire designated area at frequent intervals to insure immediate detection and location of enemy activity.
- (2) *Time allocated.* The briefing officer specifies the time allocated for each mission. This time element may be necessary to insure optimum utilization of aviation support. The aviator may be required to fly the shortest flight path, giving the observer only a one-pass opportunity to view preselected areas.
- (3) *Methods of reporting.* Radio is the primary means for reporting information. Channels, call signs, codes, and authentication procedures must be verified prior to take-off. In the event of radio failure, alternate means may be used such as message drop or landing and contacting personnel of friendly units.
- (4) *Flight Route.* The flight route is the flight path from the airfield or satellite airfield to and through the friendly forward positions. To avoid the fires of friendly mortar, artillery, and nuclear weapons and to penetrate air defense, coordination between the aviator-observer team and the operations section or aviation representative thereof is necessary when crossing the friendly forward positions.
- (5) *Altitude.* Most missions will be flown at minimum altitude to take advantage of the terrain as protection against air defense weapons, missiles, and enemy aircraft. For missions requiring higher altitudes, aircraft will be flown at the minimum altitude to the target area, then climbed rapidly for an observational pass. Upon completion of the pass, the aircraft will descend to the minimum altitude.
- (6) *Direction of observation.* The aviator-observer team must consider the approach for an observational pass to insure that the enemy, sun, shadows, terrain features, etc., do not hinder the observer's opportunity to detect the enemy.

d. *Preparation of a Checklist.* For ready reference during the flight, the aviator-observer team prepares a checklist consolidat-

ing all information needed for the conduct of the mission. It includes—

- (1) Tasks.
- (2) Available on-call artillery.
- (3) Pertinent information from the general and preflight briefings.
- (4) Necessary extracts from the SOI within security limitations.

e. Equipment Check. The final step in preflight planning is a check of the equipment to be used by the aviator and observer, to include—

- (1) Preflight inspection of the aircraft.
- (2) Serviceability inspection of special equipment such as aerial cameras, airborne radar, survival kits, flares, message drop or pickup equipment, pyrotechnics, flashlights, etc.
- (3) A last-minute check of maps, photos, recording material if used, and navigation equipment.

26. Reporting

To provide commanders and staffs with critical information during the conduct of the mission, the aviator-observer team must be able to make spot reports to the requesting unit by means of radio (the primary means), message drop, or prearranged signals. When circumstances permit, the aviator will land at or near the requesting unit to report pertinent information. If a spot report is not required while the aircraft is in the air, the debriefing officer forwards a mission report through intelligence channels to units concerned.

27. Debriefing

For maximum information, the same individual should conduct both the preflight briefing and the debriefing of the aviator-observer team. Information is consolidated into two categories—mission and general information.

a. Mission. On debriefing, the aviator-observer team is asked questions covering all aspects of the mission assigned in preflight briefing.

b. General. Any additional information obtained which was not an assigned mission task (such as areas of enemy small arms fire) or any changes in tactical maps and weather data is categorized as general information.

28. Debriefing Form

Figure 7 shows a sample debriefing format to aid the aviator-observer team in compiling mission data and to shorten the time spent in debriefing. This format may be modified as the situation requires.

MISSION NO. 4 DATE/TIME 150700 Jun 63 MAP/PHOTO Daleville Ala 1/25000
 OBSERVER Jones ORGANIZATION 20th Arm Co.
 TYPE MISSION Reconnaissance (Recon) TYPE AIRCRAFT L-19A

ITEM NO.	TARGET IDENTIFICATION	MAP/PHOTO LOCATION	TARGET DESCRIPTION	TIME OF OBSERVATION	REMARKS
1.	APC	318670	Three APC's moving north A Hill 308	0932	Directed Arty Fire
2.	Med tk (M48) troops	319682	Three soldiers repairing track at R.T.	0934	
3.	Ar mortar (42) troops	320690	One mortar well dug in; two individuals carrying large boxes.	0937	
		<u>ETC</u>			

Figure 7. Sample debriefing format.

CHAPTER 4

AERIAL OBSERVER TECHNIQUES

29. General

During missions involving direct observation, the observer is primarily concerned with detection, identification, location, and reporting. Since the observer may be hampered by maneuvers used to reduce aircraft vulnerability (evasive maneuvers), he must devote maximum ability and effort to visually observe the terrain in the time available. Observation techniques will vary with the mission and the physical environment.

a. Detection. Detection requires determination that an object or activity exists. Factors influencing the detection capability are terrain, light, altitude, airspeed (length of time the target is viewed), and visibility, as well as the deception practiced by the enemy.

b. Identification. Major factors in identifying a target are description, strength, and disposition. The observer must be able to classify targets as either friendly or enemy and to discriminate among the types of targets observed.

c. Location. The exact location of detected and identified targets is the ultimate objective of aerial observer missions. Depending upon the nature of the target, the observer may locate the center of mass and/or the boundaries of the entire area encompassed.

d. Reporting. For reporting procedures, see paragraph 26.

30. Direct Observation Techniques

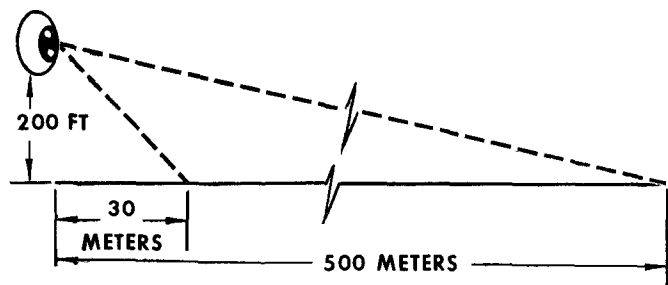
There are four areas in which observation techniques may be directly applied: *visual search*, *speed of recognition*, *geographical orientation*, and *target location*.

31. Visual Search

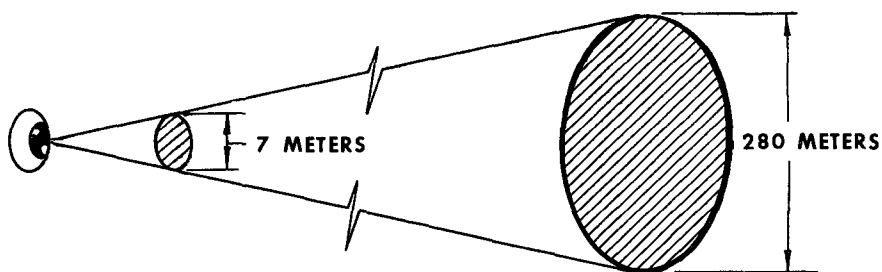
a. General. Visual search is the systematic visual coverage of a given area. This method of search is directly applicable to all Army observation aircraft. It takes advantage of the inherent capability of human vision to detect fine detail. A relatively small portion of the human eye is capable of resolving a fine detail. From an aircraft in flight, this portion will cover a pattern on the ground varying in size in relation to the distance the ground

area is from the human eye. Figure 8 shows that, from an altitude of 200 feet, an area on the ground located 30 meters from the aircraft appears to be elliptical in shape, with a long axis of 7 meters; 500 meters from the aircraft, this ellipse has a long axis of 280 meters.

- (1) From the standpoint of effective aerial observation, visual search is the hardest part of the observer's task.



SIDE VIEW



TOP VIEW

--- OBSERVER'S LINE OF SIGHT

— GROUND

Figure 8. Visual search ground patterns.

First, the observer may go through the motions of searching for a target without knowing that he is not completely or systematically covering the ground; and second, the observer is placed in a situation which taxes the limits of human observation.

- (2) The purpose of visual search is to detect targets. The targets of interest are often the fleeting and transient types, ranging in size from a foot soldier with a hand-held weapon to the largest tactical missile and launcher. Within the limits of tactical deployment, these targets may be located anywhere in the search area.

b. Capabilities and Limitations of Visual Observation.

- (1) *Area coverage.* Of particular concern to the aerial observer is this question: *How much of a designated area am I expected to search in order to provide adequate visual coverage?* The answer depends upon several factors, the most important of which are the—

- (a) Observation altitude.
- (b) Speed of the observation aircraft.
- (c) Terrain conditions.
- (d) Limitations of the human eye.

- (2) *Observation altitude.*

- (a) The higher the altitude at which the aircraft operates, the greater is the amount of terrain available to the observer for inspection. The distance that can be seen from an aircraft increases as altitude increases. For example, at an altitude of 250 feet, the horizon line for an observer is found to be at a distance of about 19 miles. At 500 feet, or double the altitude, the horizon line is extended to a distance of about 29 miles. The observer is not expected to sight even the largest targets of interest at these extreme distances.
- (b) Search distance may refer to either slant range or ground distance. In figure 9, "A" is a point on the ground track of the aircraft; "B" is the position of the aircraft at that moment, or the air point; "C" indicates the target. Then "BC" is slant range or search distance to the target, and "AC" is ground distance or search distance to the target from the aircraft ground track. Slant range varies with altitude because it is the observer's line of sight; ground distance does not. It is the ground distance which is used to locate a target on the map. When considering the detectability of targets, it is the slant range which determines whether the target is capable of being

seen, not the ground distance to the target. At altitudes above 2,000 feet, and for targets located near the ground track, altitude and slant range tend to become equivalent. At low altitudes, below 200 feet, and for targets located approximately 500 meters from the ground track, slant range and ground distance tend to become equivalent. While more terrain can be seen at high altitudes, a better visual coverage of the area adjacent to the ground track of the aircraft is possible at low altitudes. As a rule of thumb, the ground distance covered at low altitude in visual search is approximately one grid square. However, this figure is dependent upon the condition of the terrain over which the search is made.

(3) *Speed of the observation aircraft.*

- (a) The speed of visual observation aircraft is expected to range from 0 knots per hour to approximately 300 knots per hour. The upper limits of this range will not be useful in human aerial observation, but will be used instead to reduce the vulnerability of the observation aircraft. For example, at an altitude of 200 feet or below, and flying at 100 knots per hour, the aircraft is traveling over approximately 50 meters of terrain every second. This means that the observer has available for inspection, every second, a strip of terrain 50 meters by 1,000 meters.
- (b) Aircraft speed, so far as it concerns the observer, is the rate at which the terrain passes by the aircraft. If aircraft speed is held constant and the altitude is increased, the apparent rate of movement of the ground object is decreased. Conversely as the altitude of the aircraft is decreased, the apparent movement of the ground object increases.

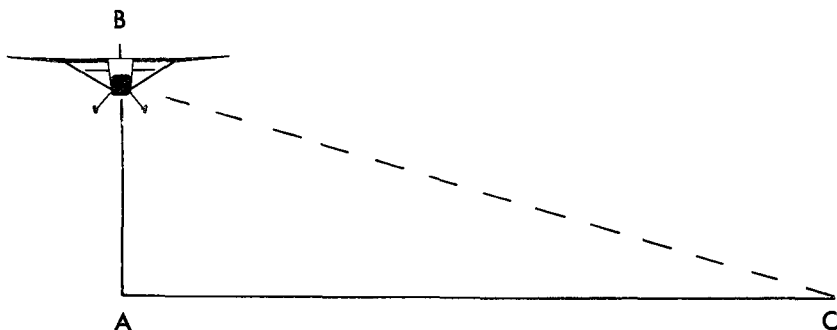


Figure 9. Diagram of search distance.

(c) Figure 10 illustrates schematically the apparent rate of ground movement at an optimal observation altitude. The direction of the aircraft is from right to left and, therefore, ground objects would appear to move toward the right as shown by the arrows. The arrows, by their varying length, indicate the apparent rate of movement for objects located at different distances from the aircraft ground track. Objects near the flight path move at a faster rate than objects out toward the horizon. As the line of sight falls on either side of a line drawn perpendicular to the flight path, the observation distance, or slant range, increases and apparent movement decreases as indicated by the arrow length. The length of these arrows when expressed numerically is called *angular velocity*, which is the number of degrees of arc through which a ground object moves per unit of time. It combines into a single expression the relationship between slant range and aircraft speed.

(4) *Terrain conditions.*

- (a) The amount of terrain that can be covered effectively in visual search is largely dependent on the type of terrain. For example, searching over dense jungle growth does not permit the degree of visual contact with the terrain that is afforded over barren wastes such as the arctic or desert regions. Consequently, the amount of search area covered would be greatly reduced.
- (b) The types of terrain which permit targets to be sighted more easily are roads; open, sandy areas; or

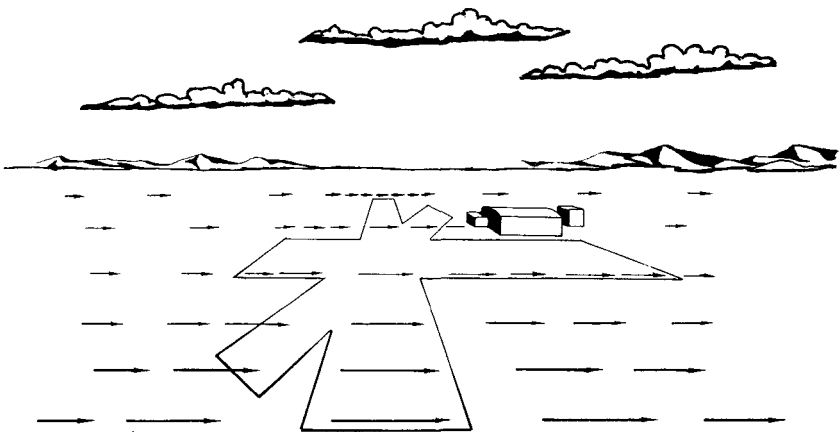


Figure 10. Motion perspective in the visual field looking to the right.

fields. Because they are easier to cover visually, aerial observers often concentrate their attention upon open areas. However, it is possible to sight down through tree stands and through the adjacent low-lying shrubs and bushes. From the air, targets are rarely seen silhouetted against the sky; they do not normally stand out from their background. Military targets with their OD paint provide poor contrast for visibility.

- (c) Terrain conditions often mask the target in such a way that it is exposed to aerial view for only a very brief period. This is particularly true in hilly or mountainous regions. Basically, when the terrain is mountainous or hilly or covered with moderate to sparse vegetation, the aerial observer can effectively cover an area of about one-half grid square from the ground track of the aircraft. In open terrain, his search depth can be extended to one grid square.

(5) *Limitations of the human eye.*

- (a) As a sensing mechanism, the human eye (fig. 11) has certain limitations. When light from a distant object enters the cornea, it passes through the pupil, the opening iris, and is focused on a light sensitive surface, the retina. Embedded in the retina are light-receiving cells, described as rods and cones, which are activated by the light rays to send impulses along their nerve attachments through the optic nerve to the visual centers in the brain.
- (b) The rods and cones differ in their functions. The rods are sensitive to very faint light, and are most effective during the hours of darkness for the detection of small light sources. But the rods are exclusively a light-dark sense as they do not respond to the different wave lengths of light by which we distinguish differences of color, nor do they contribute much to the accurate identification of form. These facts would not be important to visual search if it were not for the manner in which the rods and cones are distributed throughout the retina. Only cones are present in the foveal area, and the number of cones per unit of area decreases rapidly from the foveal toward the periphery of the retina. Each cone in the foveal transmits its impulse along a single nerve fiber. In the peripheral region, several may transmit along a single fiber. This accounts for the fact that the foveal area is that portion of the retina used in resolving fine detail in an

image. The foveal region covers a circular area of about $1\frac{1}{2}$ millimeters in diameter. A one-cent piece held $8\frac{1}{2}$ inches from the eye would just about cover the foveal area. The foveal area is that portion of the retina by which the observer senses small differences in terrain configuration that signify the target.

- (c) Figure 12 illustrates the amount of coverage by foveal vision at different ground distances from the flight path when the aircraft is at an altitude of 200 feet. At a ground distance of 30 meters from the aircraft ground track, the area covered is slightly elliptical with a long axis of 6 meeters. That is, if the aircraft were stationary, all objects within this 6-meter length would be seen in clearest detail. Objects located outside of this area would appear slightly blurred; the farther out from this area an object is located, the more blurred it would appear.

c. Visual Search Techniques and Procedures.

- (1) *Sectors.* Visual search is conducted from only one side of the aircraft at a time, with the aerial observer confining his search activity to a limited portion of his entire field of observation. This limited area is called the observation work sector and includes the orientation and

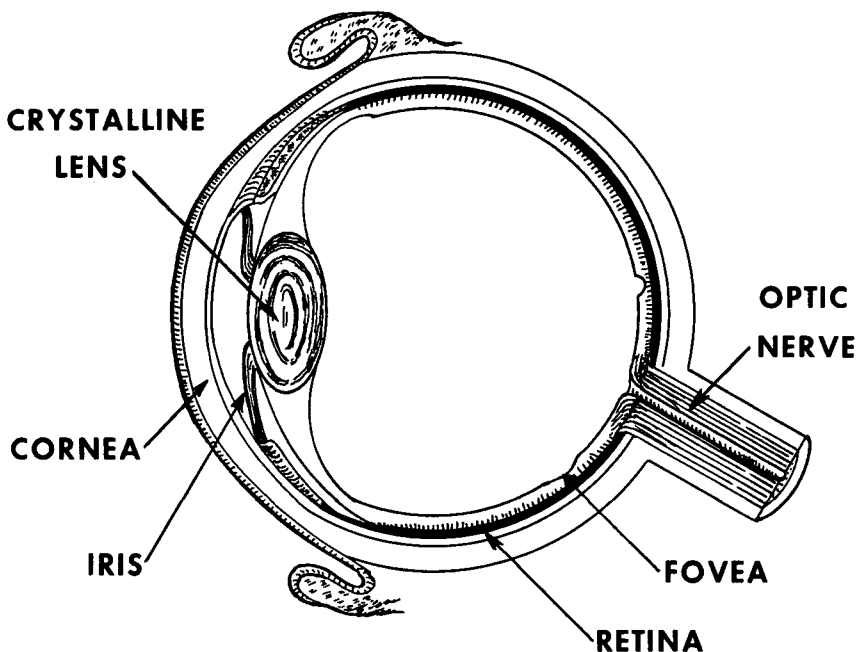


Figure 11. The human eye, showing the small area of foveal vision.

search sectors. Figure 13 depicts the observation work sector from an L-19 aircraft. The non-observational areas result from the general configuration of the L-19 and will vary with the model of the aircraft. The observation work sector is 90° forward of the line placed perpendicular to the line of flight. Forty-five degrees forward of the perpendicular line is the *search sector*. The remaining 45° of the arc is the *orientation sector*.

- (a) *Orientation sector*. The orientation sector is the forward portion of the observation work sector and is primarily used by the observer to locate terrain features for inflight orientation. By preplanning the use of prominent terrain features in preflight planning for the mission, the observer will spend a minimum amount of time in the orientation sector.
- (b) *Search sector*. The search sector is the rearward por-

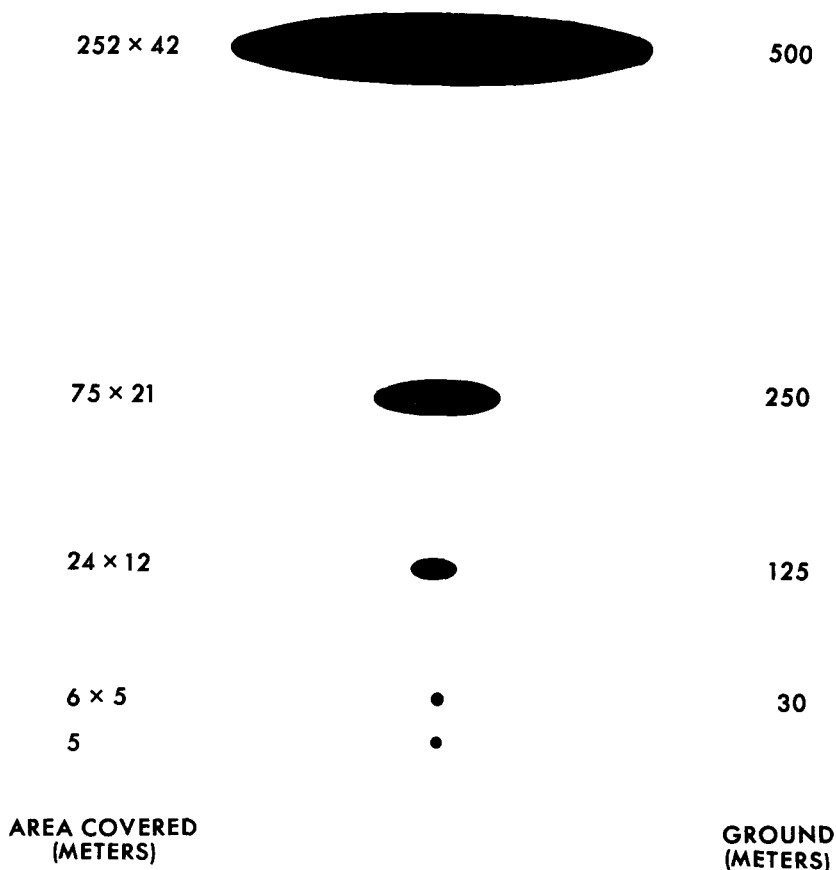
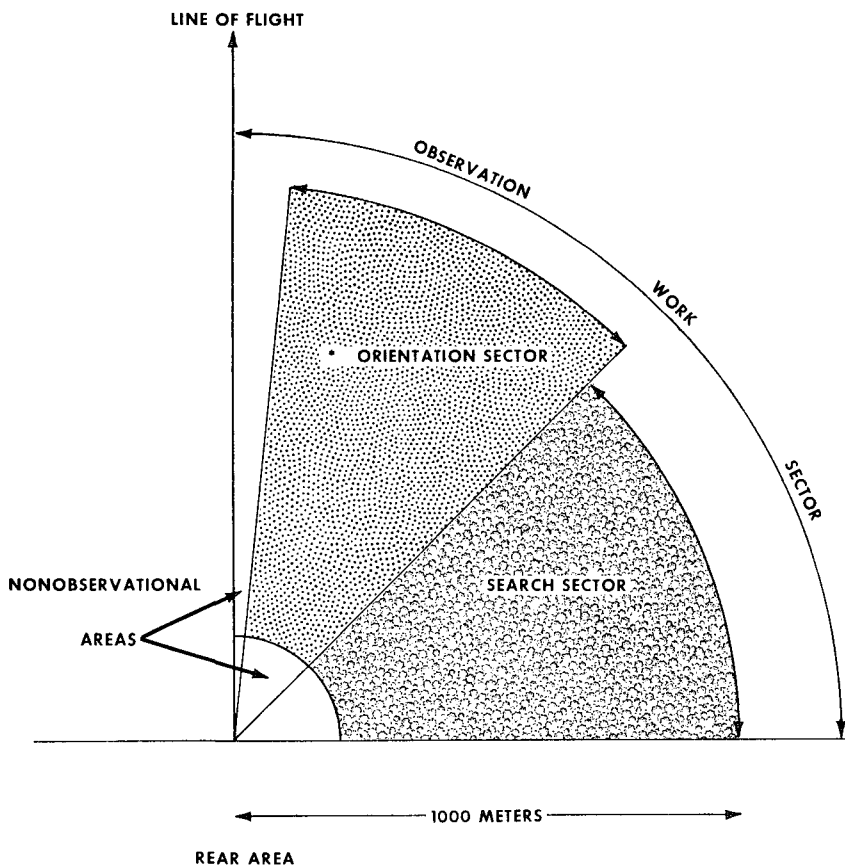


Figure 12. Ground area covered by foveal vision.

tion of the observation work sector in which the aerial observer systematically scans the terrain. It is on this sector that his attention centers during visual search.

(2) *Procedures.*

- (a) Below an altitude of 500 feet, the observer's line of sight is directed outward toward the horizon; above 500 feet, the line of sight is directed downward. Over most terrain, the aerial observer systematically (fig. 14)—



* TO ASSIST IN ORIENTATION, THE OBSERVER MAY USE ANY TERRAIN FEATURE
REGARDLESS OF ITS DISTANCE FROM THE GROUND TRACK OF THE AIRCRAFT.

Figure 13. Observation work sector (L-19).

1. Looks out toward the horizon approximately 1,000 meters and searches in toward the aircraft (Step A).
2. Looks out to one-half the distance (500 meters) toward the horizon and searches in toward the aircraft (Step B).
3. Looks out to one-fourth the distance (250 meters) toward the horizon and searches in toward the aircraft (Step C).
4. Repeats the above process.

Note. The rapidity with which the above steps are repeated is dependent upon the speed of the aircraft.

- (b) During this procedure the observer must use head movement to avoid fixating a sighted target. When a target is located in the search sector, the observer should record the information as quickly as possible by using his map and recording device, if available, and then continue his systematic search.

d. Instructors' Aids (App. II). Section II, Appendix II, contains practical guides for the presentation of visual search instruction and the preparation of training aids.

32. Target Recognition

a. Accurate and complete reports are paramount in the successful completion of an aerial observation mission. In order to develop the skills of target recognition, certain points should be understood.

- (1) *Prior experience.* Aerial observer trainees have had varying amounts of experience; therefore, it cannot be assumed that any (all) students know what a particular piece of equipment looks like.
- (2) *Effects of distance.* As eye-to-target distance increases, certain characteristics of equipment change. Observers may recognize a piece of equipment by different characteristics, and these characteristics change as the range changes. Training must include slides of equipment from near the far limits of the search sector or the limits of vision if closer. Table I shows approximate maximum detection distances.
- (3) *Vegetation.* Vegetation is referred to as *clutter*. Any target environment (background and near foreground) which varies in color or texture (trees, bushes, grass) or partly masks some of the target characteristics will affect the observer's ability to recognize a target.

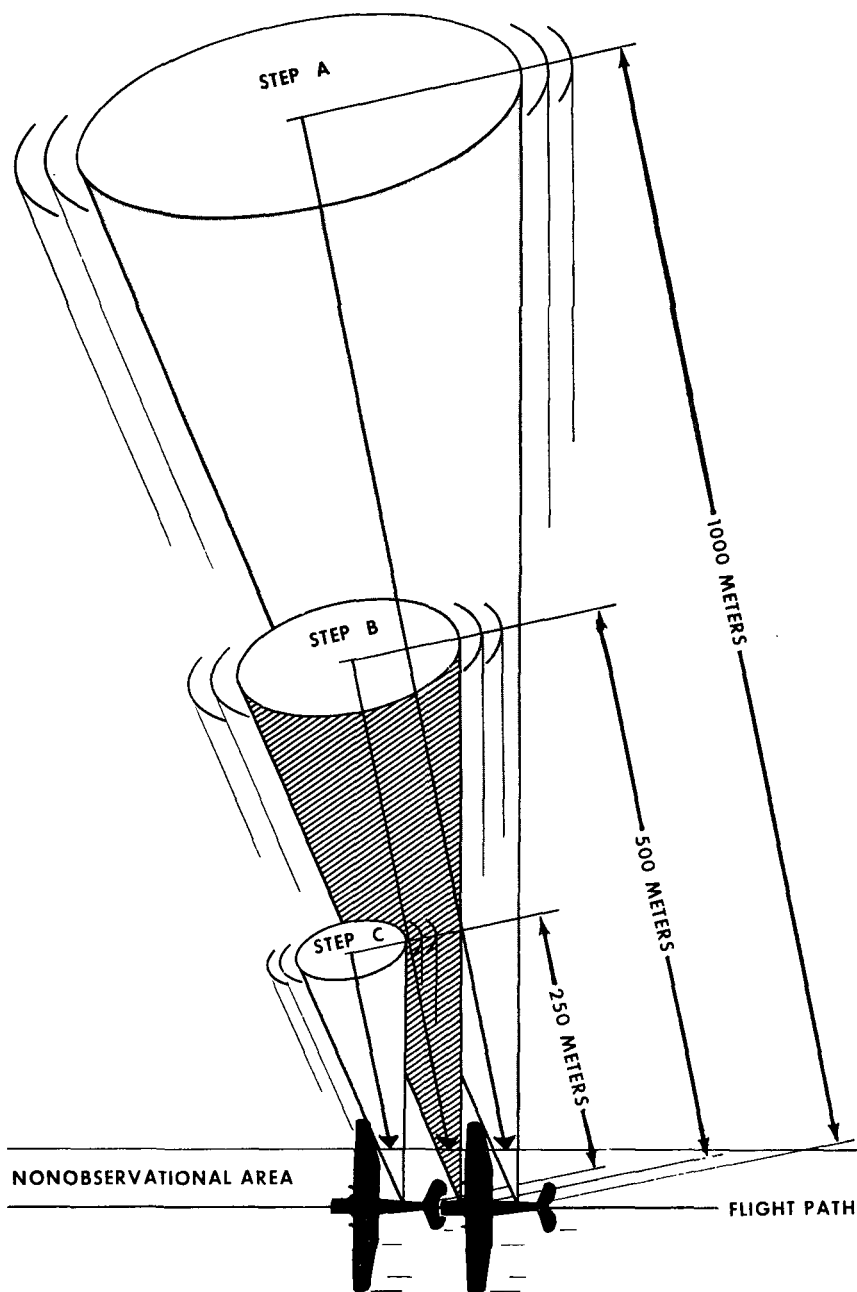


Figure 14. Search techniques (L-19).

Table I. Approximate Maximum Detection Ranges

Target	Slant Range (Meter)	Ground Distance* (Meters)
30	91	76
PRC-10	122	113
3.5	152	145
81	183	177
50	213	213
Troops	274	274
4.2	305	302
106	305	302
105	610	608
$\frac{1}{4}$	610	608
155	915	913
$\frac{3}{4}$	915	913
155 SP	915	913
$2\frac{1}{2}$	915	913
M-48	915	913

(4) *Uniqueness of equipment.* All military targets are unique by type. Although an M-48 tank and an M-47 tank are both medium tanks by class designation, they are unique by type; therefore, if an accurate description of a piece of equipment is required, the aerial observer must be *trained to that piece of equipment*. The unit which has the largest color slide coverage of items of equipment will be the most capable of adequately training aerial observers for the intelligence system requirement. Supplemental training on foreign equipment would prepare the observer for a mobilization situation.

(5) *Speed of recognition.* Because of the short available viewing time in low-level flight, the aerial observer must be trained to instantaneously respond upon sighting a target. He should have abbreviated identifying terms for all types of targets available at his command. (See Table II.) These abbreviated terms are quickly recorded and will aid in rapid identification. To prevent the observer from locking on sighted targets or looking to the rear of the search sector, he must rapidly and positively identify targets. Upon sighting targets involving numbers of items, the observer will report by actual count, when possible, or by estimate when numbers are large.

b. The accurate identification of sighted targets assists intelligence agencies in the association of items of equipment with

* Assumed mean altitude of 150 feet.

specific types of enemy units. For example if an indirect fire weapon is reported by an aerial observer as a mortar, the fact that this mortar was not reported by caliber restricts the use of this information for intelligence purposes. Had the weapon been identified as a 4.2, then intelligence personnel could have associated the information with the presence of a heavy mortar unit.

Table II. Military Items

<i>Nomenclature</i>	<i>Abbreviated Name</i>
Personnel	Troops
Truck, utility, ¼-ton, 4x4	¼
Truck, cargo, ¾-ton, 4x4	¾
Truck, cargo, 2½-ton, 6x6	2½
Truck, cargo, 5-ton, 6x6	5 ton
Truck, commercial, 1½-ton, 4x2	1½
Carrier, light weapon, infantry, ½-ton, 4x4, M-274	Mule
Trailer, ¼-ton, 2-wheel	¼ Trail
Trailer, ¾-ton, 2-wheel	¾ Trail
Gun, machine, cal 30, Browning	30
Gun, machine, cal 50, Browning	50
Mortar, 4.2-inch	4.2
Mortar, 81-mm	81
Launcher, rocket, 3.5-inch	3.5
Howitzer, 105-mm	105
Howitzer, 155-mm	155
Howitzer, self-propelled, full track, 105-mm	105 SP
Howitzer, self-propelled, full track, 155-mm	155 SP
Launcher, rocket, multiple, 4.5-inch	4.5
Rifle, recoilless, 106-mm	106
Carrier, personnel, full track, armored, M-59	M-59
Rifle, automatic, cal .30 Browning	BAR
Truck tractor, semi-trailer, M-15	M-15
Tank, combat, full track, 90-mm gun, M-47	M-47
Tank, combat, full track, 90-mm gun, M-48	M-48
Tent, 2-man	Pup tent
Radio set, AN/PRC-10	PRC-10
Radio set, AN/VRC-10	VRC-10

c. Section III, Appendix II, contains practical guides for the presentation of target recognition instruction and the preparation of training aids.

33. Geographical Orientation

a. Geographical orientation, which takes place in the orientation sector (fig. 13), is the ability of the observer to know his position relative to any geographic reference, to include maps, charts, aerial photos, or preselected terrain features. The aerial observer must be able to orient the terrain view to his map. To

facilitate this, the observer orients his map so that the flight path plotted thereon coincides with the flight path of the aircraft. This procedure avoids excessive "head in cockpit" time and permits better use of search time.

b. Geographical orientation training is valuable in correcting the two major orientation problems: *unorientation*, which occurs when the aerial observer has no geographical reference by which to determine his relative position and direction; and *disorientation*, which occurs when the aerial observer is confused as to geographical reference with respect to his relative position or direction. In this training, the observer must learn to recognize a terrain feature, orient himself in relation to that terrain feature, and locate the target with reference to the surrounding terrain. As training progresses, he should be able to shift from a geographical reference point (s) directly to the target.

c. Section IV, Appendix II, contains practical guides for the presentation of geographical orientation instruction and the preparation of training aids.

34. Target Location

a. Target location is the transposition of a sighted target on the ground to a geographical representation of the terrain, such as a map or chart. The observer must be able to record the boundary limits of the sighted target as rapidly as possible. Procedures which may be used by the aerial observer to report and record information include—

- (1) Assigning reference numbers to targets as sighted, and reporting information by verbal means such as radio or recording devices.
- (2) Reporting desired information on sighted targets, such as—
 - (a) Relative speed and direction of movement.
 - (b) Degree of cover or concealment.
 - (c) Relative position with respect to the target and surrounding terrain.

b. Target location training combines all previous training, in addition to training in target location. The observer must now—

- (1) See and recognize a target (Search and Recognition Training).
- (2) Orient the sighted target with the surrounding terrain (Geographical Orientation).

(3) Locate that target on a map or chart carried by the observer (Target Location Training).

c. Section V, Appendix II, contains practical guides for the presentation of target location instruction and the preparation of training aids.

CHAPTER 5

AERIAL OBSERVER TRAINING GUIDE

Section I. GENERAL

35. Purpose

This chapter is a guide for commanders in establishing and conducting a visual aerial observer training course.

36. Responsibility

Commanding officers of Army aviation units are directly responsible for the conduct, efficiency, and results of aerial observer training within their parent organizations, which includes the training of observers from brigades, combat commands, battalions, and squadrons.

37. Authority

- a. Chapter 4, AR 40-501 prescribes the physical requirements for observer training.
- b. AR 600-106 authorizes flight status for observers.

38. Training Objective

The objective of observer training is to qualify selected personnel from the supported ground units as aerial observers.

39. Scope

Aerial observer training will be designed to meet the needs of each branch of service concerned and will be of adequate length to fulfill the observation requirements.

- a. AR 95-51 outlines the scope and minimum number of hours required for the observer training course.
- b. Appendix II provides a practical guide for the presentation of basic skills instruction and the preparation of training aids.

Section II. SELECTION CRITERIA

40. Trainees

When selecting personnel to be trained as observers, the following should be considered:

- a.* Physical profile.
- b.* Diversified experience in basic branch.
- c.* Desire to fly.
- d.* Previous flying experience.

41. Instructors

Qualifications to be considered in selecting instructors to conduct observer training are that the individual—

- a.* Is airplane and helicopter qualified.
- b.* Is qualified in one of the branches closely related to aerial observation (armor, infantry, or artillery).
- c.* Has other related specialized training, such as that required for combat intelligence, aerial photography, communications, or air-ground operations.

Section III. PLANNING

42. General

In planning an observer training course, Army aviation unit commanders, operations officers, and instructors must consider the—

- a.* Specific training objectives.
- b.* Training variables.
- c.* Methods of instruction.
- d.* Program of instruction.
- e.* Equipment availability.

43. Specific Training Objectives

The training course must prepare the individual to—

- a.* Detect, identify, locate, and report friendly and enemy personnel and equipment, and combat area activity.
- b.* Use special equipment (photographic, electronic, and CBR).
- c.* Adjust the fire of indirect fire weapons from the air.
- d.* Plan surveillance and reconnaissance missions (using maps and aerial photos), to include the flight paths, altitudes, checkpoints, etc.
- e.* Analyze terrain conditions and report changes in terrain which do not appear on maps.
- f.* Report information to appropriate agencies clearly, concisely, and accurately.
- g.* Understand the pilot techniques of level flight and of landing the aircraft.

44. Training Variables

In any training situation, a number of variables affect the methods of training used, time allotted for training, and the program of instruction. These variables include the—

- a. Training mission.
- b. Training status of the individual and the unit.
- c. Personnel situation.
- d. Time available for training.
- e. Training areas and facilities.
- f. Weather and climatic conditions.
- g. Status of equipment.
- h. Special subjects to be stressed.

45. Methods of Instruction

To insure maximum effectiveness and uniformity of instruction, the commander must determine the best methods for utilizing instructors, presenting subject material, and conducting the training course. Specific training methods are given in FM 21-5.

a. It is desirable to use the same instructors throughout the course (during the individual and team phases of training).

b. Subject material should be presented in conferences, demonstrations, or practical exercises. Lectures should be avoided. The maximum number of field exercises should be included to give the student practical application of his classroom training.

c. The training course is divided into two phases—individual and team.

(1) *Individual.* Individual training encompasses the necessary hours of ground and flight subjects to prepare the individual to work as a member of the aviator-observer team.

(2) *Team.* Team training establishes the aviator-observer team and qualifies the individual as an observer.

d. Classroom training should be designed to teach effective aerial observer techniques and procedures for actual flight, with emphasis on speed, accuracy, and completeness.

(1) Flight training is scheduled immediately after visual search, recognition, geographical orientation, and target location training to better associate classroom instruction with practical application.

(2) Flight training should begin with a brief orientation for the students, as a group, stressing the capabilities of the aircraft to withstand normal, marginal, and emer-

gency operational or technical situations. This should be followed immediately with a demonstration at the airfield depicting normal landings and takeoffs, simulated short field landings and maximum performance takeoffs, simulated takeoffs over barriers, power-off landings simulating marginal and emergency situations, and low altitude 360° and 720° steep turns demonstrating the stability and controllability of the aircraft. The students should be encouraged to ask questions while observing the demonstration.

- (3) After the orientation and demonstration, the student aerial observers should be given an orientation ride not to exceed 30 minutes. The aircraft used should be of the same type as those to be used later on in the training program. The aviators conducting these rides should be the instructors for the course and must insure that this ride does not include any violent maneuvers. The best flight altitude is 1,000 feet, and over an area readily recognizable by the student. The student should be encouraged to discuss his impressions of various sightings.
- (4) Upon completion of the introductory ground training, an average student requires a minimum of 15 training flights before he may be considered to have marginal training as an aerial observer. Normally, 25 training flights are required to qualify a student as an effective aerial observer. Therefore, the 20 flying hours included in the aerial observer program of instruction given in AR 95-51 can best be utilized as follows: (1) one 30-minute orientation ride; (2) five 30-minute training flights (at the beginning of the flying portion of the course); (3) seven 1-hour training flights; and (4) the remaining 10 hours used for training flights of varied duration but not to exceed 2 hours at any one time.

Section IV. PROGRAM OF INSTRUCTION

46. General

a. This section contains a recommended POI for conducting observer training in the armored, mechanized, infantry, and airborne divisions, and armored cavalry regiments. This program is designed to produce observers capable of rapidly and effectively accomplishing any division observation requirement. However, the commander must continually evaluate the training course and

modify the POI to meet his particular mission and unit requirements.

b. Subjects to be taught in the individual and team phases of training are given in the paragraphs below.

47. Individual Training

- a. Principles of aerial surveillance.
- b. Principles of combat intelligence.
- c. Duties of the aerial observer.
- d. Familiarization with aircraft, safety devices (safety belts, shoulder harnesses, parachutes), and emergency procedures.
- e. Elementary air navigation.
- f. Elementary meteorology.
- g. Communications: equipment, operation, and proper radio voice procedure.
- h. Map and aerial photograph reading.
- i. Recording and reporting information.
- j. Briefing and debriefing.
- k. Use of binoculars, photographic equipment (familiarization)
- l. Preflight planning.
- m. Visual search techniques.
- n. Recognition training.
- o. Identification of foreign material and tactical installations.
- p. Damage assessment.
- q. Geographical orientation.
- r. Target location.
- s. Radiological survey.
- t. Aerial photography.
- u. Adjustment of fire.

48. Team Training

For maximum effectiveness, team training should be integrated in field exercises that include aviation units.

- a. *Principles of Intelligence.*
 - (1) Briefing and debriefing.
 - (2) Maintenance of situation map.
- b. *Navigation.*
 - (1) Flight planning, low level navigation.
 - (2) Actual flight, low level navigation.

c. Aerial Surveillance.

- (1) Preflight planning, visual surveillance mission.
- (2) Conduct of a visual surveillance mission.

d. Aerial Reconnaissance.

- (1) Preflight planning, specific search, and route reconnaissance missions.
- (2) Conduct of specific search and route reconnaissance missions.
- (3) Preflight planning, radiological survey missions.
- (4) Conduct of radiological survey (actual flight).
- (5) Adjustment of fire (actual adjustment of mortar and artillery fires).

e. Aerial Cameras.

- (1) Practical exercise, spot photos (actual flight).
- (2) Practical exercise, strip and mosaic photos.

f. Field Exercise (actual flight—2 days).

- (1) Participate with ground troops.
- (2) Operate day and night.
- (3) Perform at least one of each type mission.

APPENDIX I

REFERENCES

AR 40-501	Standard of Medical Fitness.
AR 95-51	Flying Status for Air Observers.
AR 220-50	Regiments; General Provisions.
AR 220-60	Battalions, Battle Groups; Squadrons; General Provisions.
AR 220-70	Companies; General Provisions.
AR 320-5	Dictionary of United States Army Terms.
AR 320-50	Authorized Abbreviations and Brevity Codes.
AR 350-1	Army Training Policies.
AR 600-106	Aeronautical Designations and Flying Status for Army Personnel.
FM 1-5	Army Aviation; Organizations and Employment.
FM 1-100	Army Aviation.
FM 5-20	Camouflage; Basic Principles and Field Camouflage.
FM 5-34	Engineer Field Data.
FM 5-36	Route Reconnaissance and Classification.
FM 6-40	Field Artillery Cannon Gunnery.
FM 6-135	Adjustment of Artillery Fire by the Combat Soldier.
FM 7-40	Infantry and Airborne Division Battle Groups.
FM 7-100	Infantry Division.
FM 11-40	Signal Corps Pictorial Operations.
FM 17-1	Armor Operations; Small Units.
FM 17-95	The Armored Cavalry Regiment.
FM 17-100	The Armored Division and Combat Command.
FM 21-5	Military Training.
FM 21-6	Techniques of Military Instruction.
FM 21-26	Map Reading.
FM 21-30	Military Symbols.
FM 30-5	Combat Intelligence.
FM 30-20	Aerial Surveillance—Reconnaissance, Field Army.

FM 57-30	Airborne Operations.
FM 57-35	Airmobile Operations.
FM 57-100	The Airborne Division.
FM 61-100	The Division.
FM 100-5	Field Service Regulations ; Operations.
FM 101-5	Staff Officers Field Manual; Staff Organization and Procedure.
TM 1-250	Principles of Fixed Wing Flight.
TM 1-260	Principles of Rotary Wing Flight.
TC 101-2	Tactical Operations Centers.
DA Pam 108-1	Index of Army Motion Pictures, Film Strips, Slides, and Phono-Recordings.
Da Pam 310- Series	Military Publications Indexes.

APPENDIX II

INSTRUCTORS' AIDS

Section I. INTRODUCTION

1. General

The information contained in this appendix is intended primarily for use by aerial observer course instructors. It covers the practical aspects of presentation of instruction and the preparation of training aids pertaining to visual search training, recognition training, geographical orientation, and target location.

2. Training Aids

The training aids included in this appendix are examples of training aids which will add to the effectiveness of the aerial observer course presentation. Local requirements and production capability will govern the type and number of training aids available for use.

Section II. VISUAL SEARCH TRAINING

3. Guide for Presentation of Visual Search Training

a. General. Classroom instruction should be closely integrated with practical exercises. The aircraft should be of that type predominantly used by the unit in aerial observer missions. Prior to the student's arrival, the aircraft is parked in a level flight attitude. (For the L-19, the brakes are locked, the aircraft chocked, and a sawhorse placed under the tail jack point.) Strips of engineer tape (approximately 25 meters) are nailed to the ground to delineate the search orientation sectors. If small-scale models of military equipment are available, these are placed in the search sector for realism. Upon arrival at the aircraft, the student occupies the observer's seat and all safety items (parachute, helmet, restraining harness, etc.) are fitted and secured. The instructor takes a position near the observer to one side of the observational work sector.

The observer practices head and eye movement, searching in the prescribed manner. The instructor should insure that the student actually moves his head while practicing. When satisfied that the student has utilized the proper head movement and has noted the

location of the work sectors in relation to the aircraft, the instructor may release him. He then repeats this procedure for each student in the class.

b. Inflight Instruction Requirements. Requirements for inflight instruction include—

- (1) Aviator training.
- (2) Controlled terrain.
- (3) Observation aircraft.
- (4) Recording materials (air-to-ground radio or notebook).
- (5) Ground targets.

c. Aviator Training.

- (1) The primary role of the aviator is that of an assistant instructor; merely flying the observer over a training course is not sufficient. All aviators must be standardized on the—
 - (a) Exact flight path.
 - (b) Instructional methods and procedures.
 - (c) Method of critique.
- (2) It is the responsibility of the instructor to insure that the aviators are all flying the same flight path and that airspeed and altitude are similar. Pretesting the aviators is required to insure accuracy of flight.

d. Controlled Terrain. Controlled terrain is ground area over which the aerial observer school has control with only those target objects required for training placed therein. It is necessary for the instructor to be able to determine whether or not the student sighted a particular target. If the terrain is uncontrolled, the critique following flight is unsatisfactory in that it is difficult to determine whether or not the student was correct in his sightings and whether or not he performed visual search properly.

e. Observation Aircraft. Current types of observation aircraft used by the aerial observer in actual operation should be employed.

f. Recording Material. Any activity which requires the aerial observer to move his eyes away from the terrain will reduce his performance level. The best method is to use an inflight recorder; however, these may not be readily available. An air-to-ground radio may be used with assistant instructor transcribing the observer's response. The least desirable method, because the eye loses contact with the terrain, is note-taking by the observer while in flight.

g. Ground Targets. The primary purpose of the observer's visual search mission is to allow him to practice what he has learned in classroom instruction. Large targets such as 5-ton

trucks, 2½-ton trucks, or other military equipment of this category are most desirable. Placing small items such as 4.2-inch mortars or 30-cal. machine guns will not enhance training at this time. The positioning of these items is contingent upon the terrain being used. (See diagrams of visual search area, figs. 15 and 16.)

h. Inflight Training. Four steps to be considered in inflight training are preparation, demonstration, inflight practice, and critique.

- (1) *Preparation.* All previous visual search training material plus the actual preparation of the aerial observer for the mission is included in the preparation phase. The student must be secured in the aircraft, instructed as to the direction in which to search, and briefed on any instructions that the aviator may give him while in flight.
- (2) *Demonstration.* Mainly this demonstration should include extremely low-level flying (50 feet and below). While en route to the training area, the aviator demonstrates the change in the apparent movement of ground objects whenever the aircraft's speed/altitude varies.

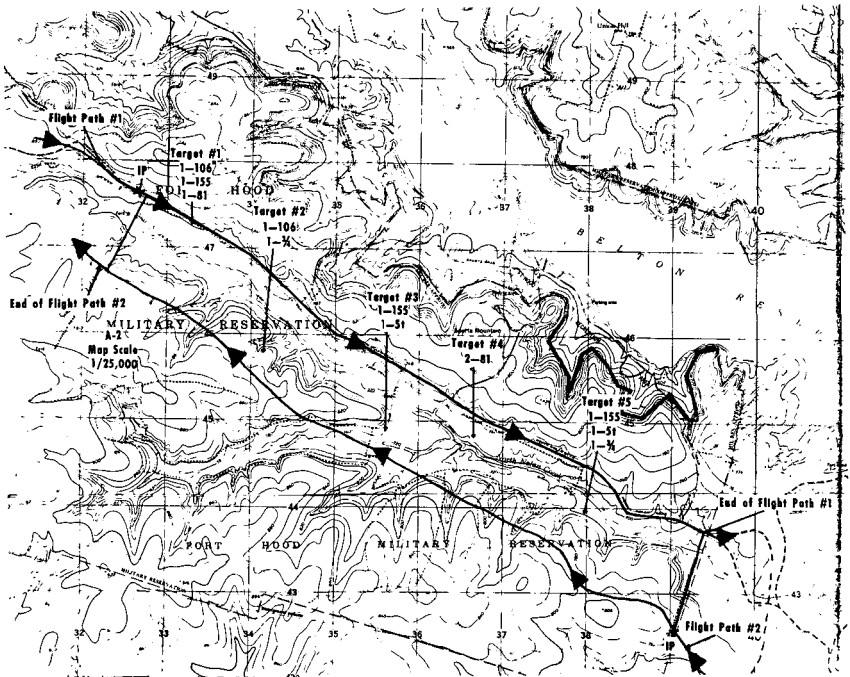


Figure 15. Type target course for visual search training, target area A-2.

- (3) *Inflight practice.* Prior to entry on the training course, the aviator alerts the observer that in (x) seconds he will be in the training area; he again tells him the direction in which to look. The aviator then stabilizes his observation altitude at 50 feet or below (depending on terrain) and tells the observer when he is over the starting point of the course. After flying the course, he tells the observer that the flight course has ended. The aircraft is then flown back to the starting point and the aviator tells the observer that he will refly the course and point out the targets to him.
- (4) *Critique.* While reflighting the course, the aviator points out all targets to the observer. Four problems will be of primary interest:

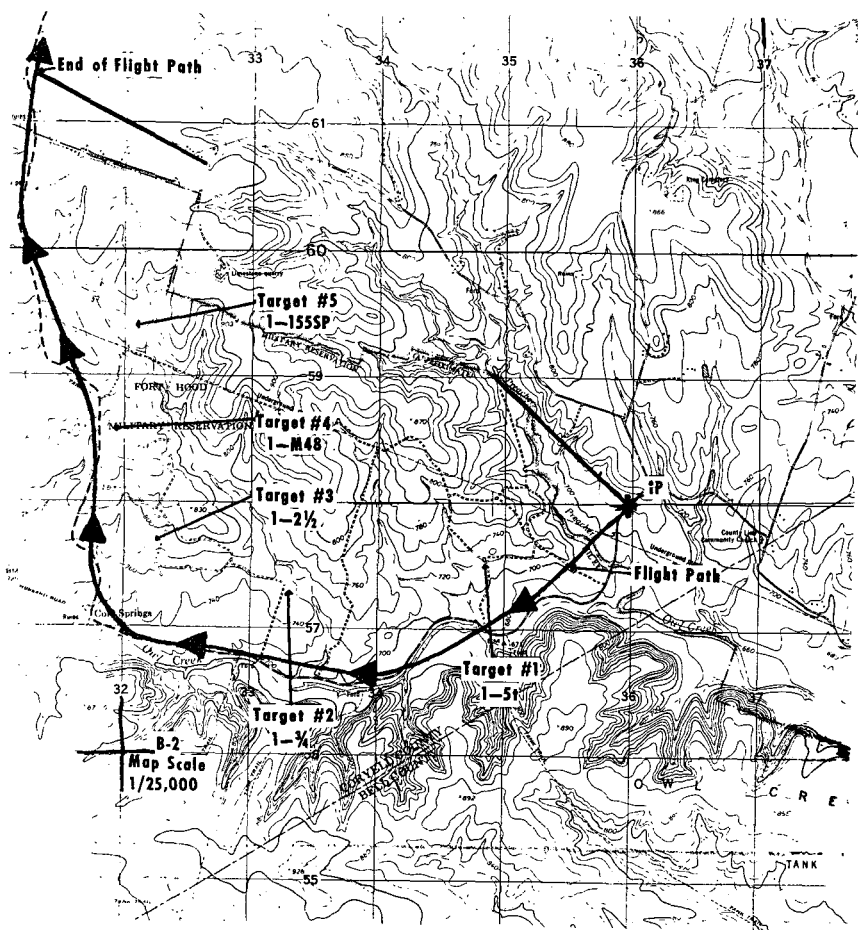


Figure 16. Type target course for visual search training, target area B-2.

- (a) *Problem 1:* Observer did not report enough of the distant targets.
Possible Cause: Observer is not scanning out far enough.
- (b) *Problem 2:* Observer did not report enough of the near targets.
Possible Cause: Observer is not scanning in close enough.
- (c) *Problem 3:* Observer had few reports when compared to actual target display.
Possible Cause: Observer did not scan rapidly enough.
- (d) *Problem 4:* Observer reports only one target when two were in line, one near and one far.
Possible Cause: Observer is "locking" his eyes on a single target too long. To aid in correcting this, a 5-inch mirror attached to a rubber section cup may be placed inside the aircraft in a position which will allow the aviator to monitor the observer's head movement while in flight. If the aviator notes that head movement is not occurring during flight, he should remind the observer to move his head.
- (5) *Debriefing.* Upon completion of the flight, the observer should be debriefed by the classroom instructor to ascertain any visual search problems encountered while in flight and to give corrections.

4. Guide for Development of Training Material

Materials to be used include a terrain board, vugraph slides, and blackboard or charts.

a. *Terrain oBard* (fig. 17). The board display should be drawn with the dimensions of depth to show the angle covered by foveal vision (5°). When this angle is used, the terrain area covered greatly increases as the range increases. Movable strings threaded through a hole in the drawn observer's eye (in cockpit of depicted aircraft) allows the instructor to move the strings from a near location to a far location, thereby indicating that foveal area coverage changes with distance.

b. *Vugraph Slides.* All illustrations shown in the visual training portion of chapter 4 plus those shown in this section of the appendix may be made into vugraph slides and used to enhance the instruction of aerial observers.

c. *Blackboard or Charts.* In drawing the search sector, such as in figure 13, metallic strips may be used to delineate the work areas, thereby allowing variations in the forward limits of the



Figure 17. Terrain board.

orientation sector to change, dependent on the type aircraft used. Search patterns may also be drawn showing visual search techniques (fig. 14).

Section III. RECOGNITION TRAINING

5. Guide for Presentation of Recognition Training

a. Classroom Training.

- (1) *Method of presentation.* A variety of slides will be shown the students in the classroom. The projectionist will show a slide for 5 seconds. Individuals in the classes are instructed to *verbally* respond first, then write their answers on their worksheets. A sample worksheet is shown in figure 18. Motivation may be accomplished by calling on certain individuals to describe why they called it what they did. Testing procedures may be implemented by merely deleting the verbal response. A method of abbreviated reporting is listed in table II (par. 32).
- (2) *Sequence of presentation.* The slides are presented in a systematic, progressive manner. The initial stage places the observer near a single target and without surrounding clutter; the sequence gradually progresses until maximum viewing distance and maximum clutter are shown. Figures 19 through 25 illustrate the type slides to be used in this presentation.

b. Inflight Practice.

- (1) The following guidance used in visual search training is also applicable for inflight target recognition practice.
 - (a) Aviator training.
 - (b) Controlled terrain (a type course is shown in fig. 26).
 - (c) Recording procedures.
 - (d) Aviator procedures.
 - (e) Critique.
- (2) Additional requirements for inflight practice are ground and target conditions. Where possible, the equipment placed on the target course should cover all conditions discussed in the classroom, to include distance to target, clutter, single and multiple target presentations, and types of targets. Prior selection of target placement areas is important in order to offer varying conditions to the aerial observer.

NAME _____ RANK _____ SERIAL NO. _____

ORGANIZATION _____

SESSION NO. R- _____

DATE _____

SLIDE NO.	TARGET(S)	SLIDE NO.	TARGETS(S)
1		16	.....
2		17	.....
3		18	.....
4		19	.....
5		20	.....
6		21	.....
7		22	.....
8		23	.....
9		24	.....
10		25	.....
11		26	.....
12		27	.....
13		28	.....
14		29	.....
15		30	.....

Figure 18. Recognition training worksheet.



Figure 19. Recognition training slide: 5-ton cargo truck, condition SR₂Q₂.



Figure 20. Recognition training slide: 5-ton cargo truck, condition SR₂Q₂.

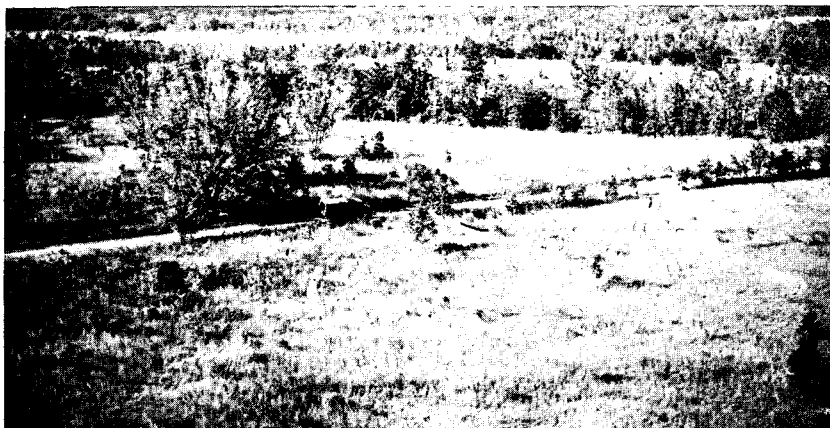


Figure 21. Recognition training slide: 5-ton cargo truck, condition SR_3C_2 .



Figure 22. Recognition training slide: 5-ton cargo truck, condition SR_2C_3 .



Figure 23.. Recognition training slide: 2 M-59's, 1 M-48, low difficulty level.



Figure 24. Recognition training slide: 2 M-48's, 1 M-59, medium difficulty level.



Figure 25. Recognition training slide: 2 M-48's, 2 M-59's, high difficulty level.

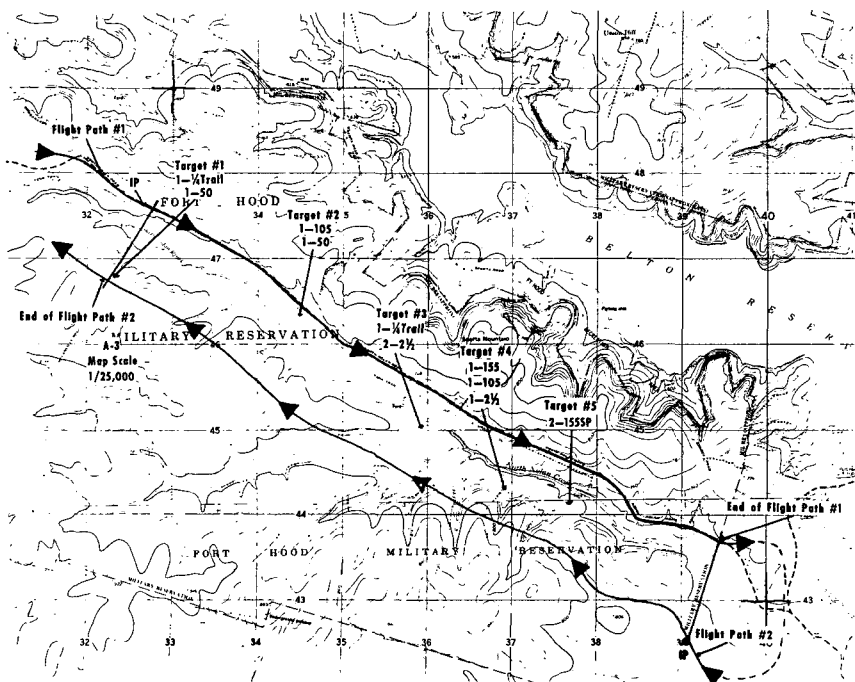


Figure 26. Type target course for target recognition training, target area A-3.

6. Guide for Development of Training Material

Materials and equipment used are an observation helicopter, 35-mm camera and color film, and military equipment (target objects such as M-48 tank, $\frac{3}{4}$ -ton truck, etc.).

a. *Training Material.* The 35-mm color slides, when shown in the classroom, provide inflight views of military items of equipment. The slides should show all items that the observer must be trained to recognize under varying conditions of distance and natural concealment. The observer must be able to recognize targets at all distances within the capability of the human eye (table I of text), and to recognize targets when they are partially obscured by surrounding vegetation. A method for doing this is to establish at least three categories for both the distance to the target and the amount of surrounding vegetation. For this purpose the distance to the target will be defined as *slant range* (SR) and will vary from near distances (SR_1) through medium distances (SR_2) to far distances (SR_3). The surrounding vegetation will be defined as *clutter*. Clutter will vary from parade ground vegetation (C_1) through light brush or trees (C_2) to heavier obscuring vegetation (C_3).

- (1) *Slant range (SR).* The slant range is the distance from the eye (camera) to a particular object being viewed (photographed). Slant range considered herein will be translated into the ratio of the major axis of a piece of equipment to the total lateral area of a 35-mm slide. (As altitude decreases toward zero, the slant range gradually becomes ground distance.)
 - (a) *Slant range 1 (SR_1).* Slides illustrating SR_1 should be taken from a distance which results in the major axis of the target being not less than one-fourth the width of the slide. In terms of detail, all the major and most of the minor details which contribute to the uniqueness of the item are apparent.
 - (b) *Slant range 2 (SR_2).* Slides illustrating SR_2 should be taken from a distance which results in the major axis of the target being approximately $1/10$ to $1/4$ the width of the slide. All of the major details which contribute to the uniqueness of the target are clear at these distances, but the minor details are not as obvious as at SR_1 .
 - (c) *Slant range 3 (SR_3).* Slides illustrating SR_3 should be taken from a distance which results in the major axis of the target being less than one-tenth the width of the

slide. At these distances, all of the minor and some of the major details of the items appear indistinct.

(2) *Clutter*. Clutter is defined as vegetation and the property of the terrain, to include color and texture of the area surrounding the target.

(a) *Clutter 1 (C_1)*. The items in slides illustrating C_1 should be photographed against a relatively homogeneous background, such as a parade ground, so that the item is in full view and dominates the slide.

(b) *Clutter 2 (C_2)*. These targets should be photographed near distinctive terrain features, vegetation, or shadows. In the case of small weapons, semitactical positions (i.e., machinegun emplacements) are employed. The items are placed in such a manner that they are either separated from or adjacent to the background features, but in no case is more than one-third of the item obscured by such features.

(c) *Clutter 3 (C_3)*. Items in slides illustrating C_3 should be photographed against backgrounds which contain more irregularities than those of the C_2 slides. The items are placed so that, in terms of color and configuration, advantage can be taken of natural camouflage. The actual amount of concealment offered by this camouflage results in not more than two-thirds of the item being covered; generally, one-half or less of the item is concealed. In no case, however, is the item separated from the background features.

b. *Pictorial Method of Development*. The slides used in recognition training should be taken from an altitude of 50 to 200 feet above the altitude of the target. The photographer, when looking through the viewfinder, should use the guidelines established in slant range, above. All slides are taken in color, and the orientation of the target to the camera (e.g., end view, side view, and variations thereof) is *unsystematically* varied. This permits a complete coverage of a target item from all views.

c. *Total Requirement*. Approximately 340 usable slides are required: 160 of single targets (SR_1C_1 through SR_3C_3) and 180 of multiple targets (2 to 6 items, low through high difficulty).

d. *Film Cataloguing*. After slides are selected, they should be catalogued and numbered in sequence in this manner:

Period 1 Slides 1-40	(SR_1C_1)	Single items
Period 2 Slides 41-100	(SR_2C_2)	Single items
Period 3 Slides 101-160	(low difficulty level)	Multiple items



Figure 27. Geographical orientation slide for grid 3-D, map F; photographed from 180° at 2,000 feet.



Figure 28. Geographical orientation slide for grid 3-D, map F; photographed from 180° at 1,100 feet.

Period 4 Slides 161–240 (SR ₃ C ₃)	Single items
Period 5 Slides 241–300 (medium difficulty level)	Multiple items
Period 6 Slides 301–340 (high difficulty level)	Multiple items

Note. A slide key, listing slide number(s) and target(s), should be made a portion of the narrative for projectionist and instructor reference.

e. Multiple Target Combinations. It is necessary to modify the categories of slant range and clutter when developing multiple targets. The slant range and clutter values for a 1/4-ton truck are not the same as for a 5-ton truck. When these two items are placed together in a multiple target situation, the instructor will have to categorize the slide based on his opinion as to whether its difficulty level is low, medium, or high.

Administrative Caution: When developing a film library, caution should be taken to insure that the level of difficulty does not exceed the observer's ability. This may occur when a vehicle is shown in the woods, making the difficulty level of the picture exceed the observer's capability of discriminating the object. All targets should fall within the average maximum detection ranges given in table I of text.



Figure 29. Geographical orientation slide for grid 3–D, map F; photographed from 180° at 200 feet.

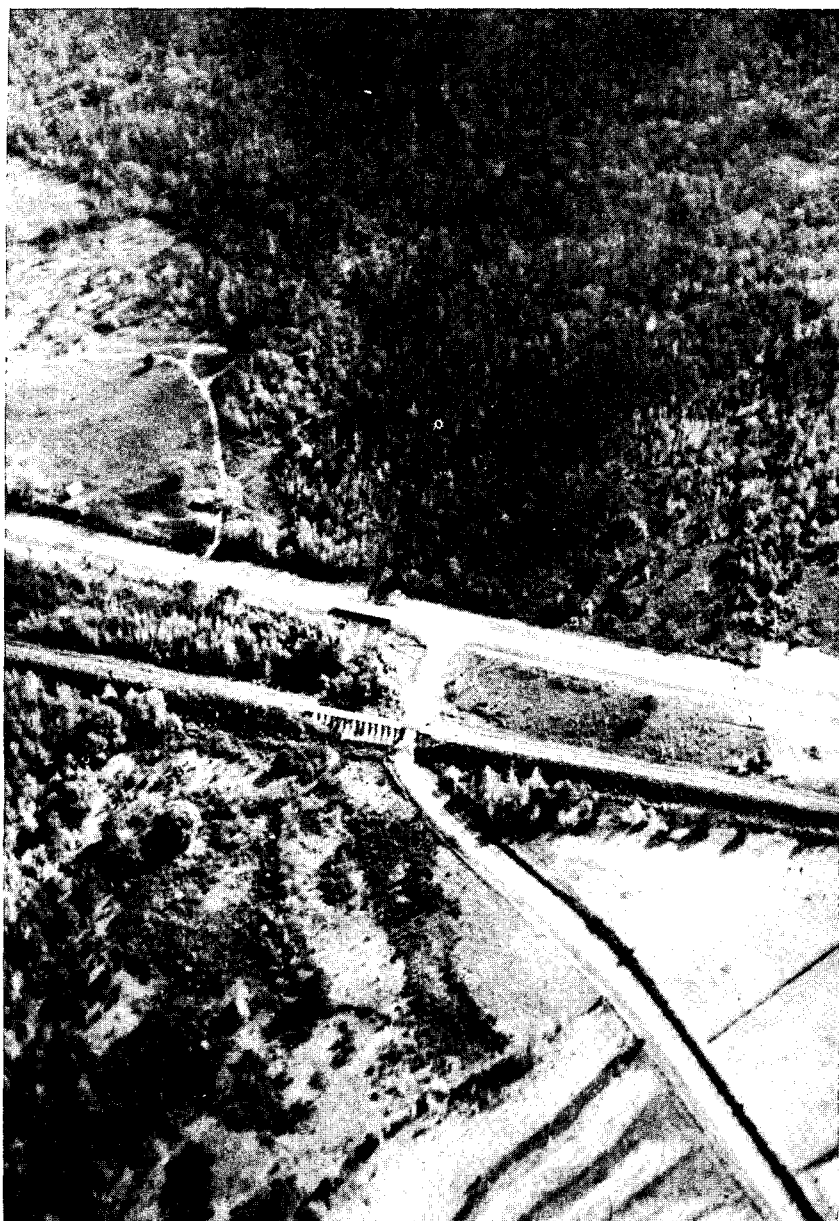


Figure 30. Geographical orientation slide for grid 3-D, map F; photographed from 360° at 2,000 feet.

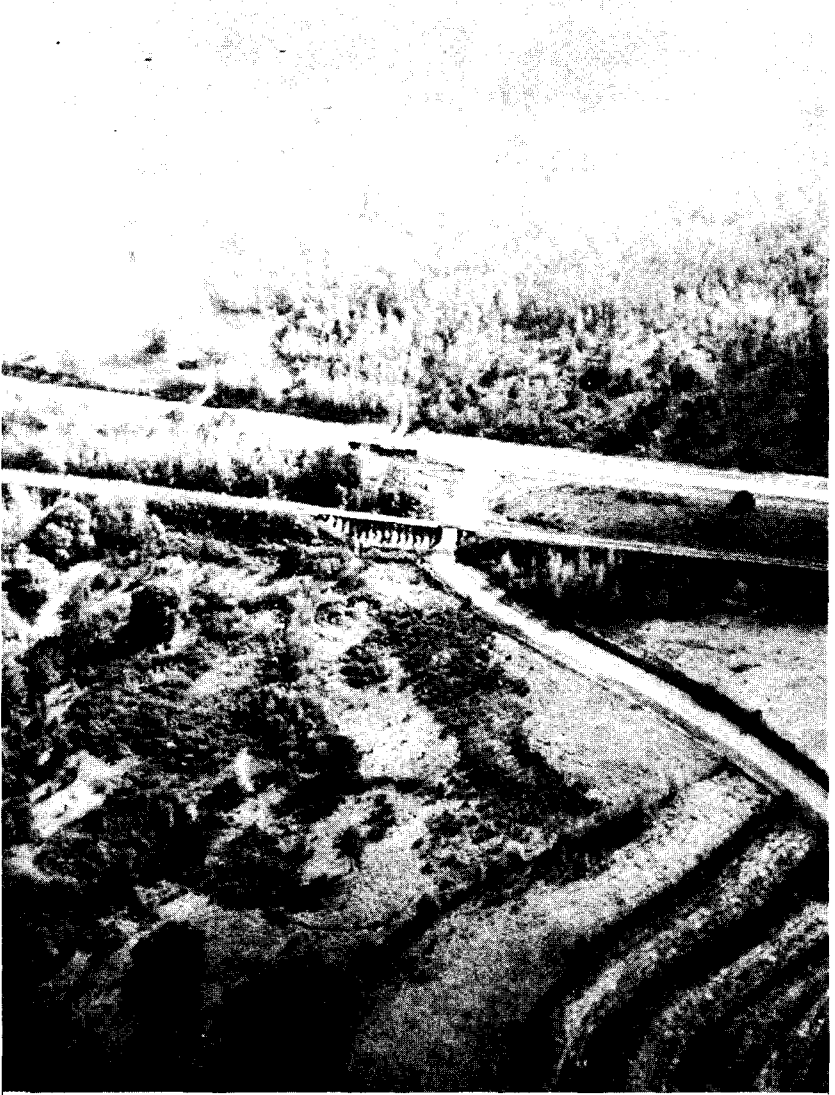


Figure 31. Geographical orientation slide for grid 3-D, map F; photographed from 360° at 1,100 feet.

Section IV. GEOGRAPHICAL ORIENTATION

7. Guide for Presentation of Geographical Orientation Training

a. Classroom Training.

- (1) *Method of presentation.* The aerial observer receiving geographical orientation training is shown colored slides of various terrain features. The photographs are taken from three altitudes above the level of the terrain feature and from eight different directions (figs. 27-35). These varied views should give the observer a good idea of how the appearance of a terrain feature can change relative to the angle and height from which it is seen. To give the observer optimum practice in geographical orientation, presentation of slides should be varied at random by altitude and height.
- (2) *Sequence of presentation.* Progressive levels of difficulty, contingent upon geographical terrain features available in the unit area, must be determined by the instructor (par. 8b).
- (3) *Maps.* The maps used in training are folded and inserted in an acetate binder (fig. 36). In order to reuse the folders, the acetate is marked with UMT grid crosses in four corners. The top margin is labeled A, B, C, etc., and

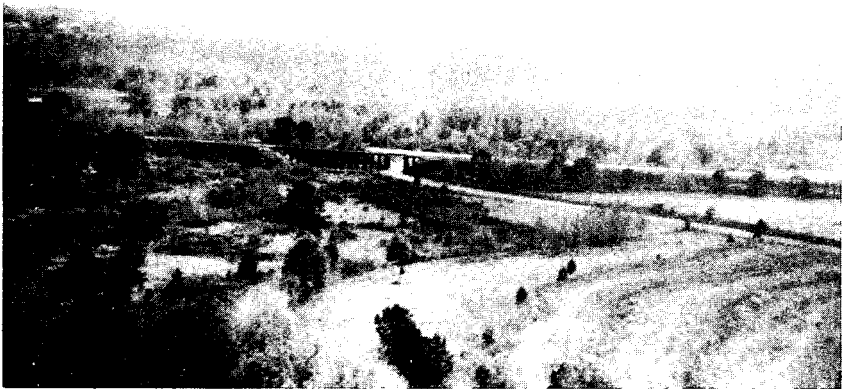


Figure 32. Geographical orientation slide for grid 3-D, map F; photographed from 360° at 200 feet.

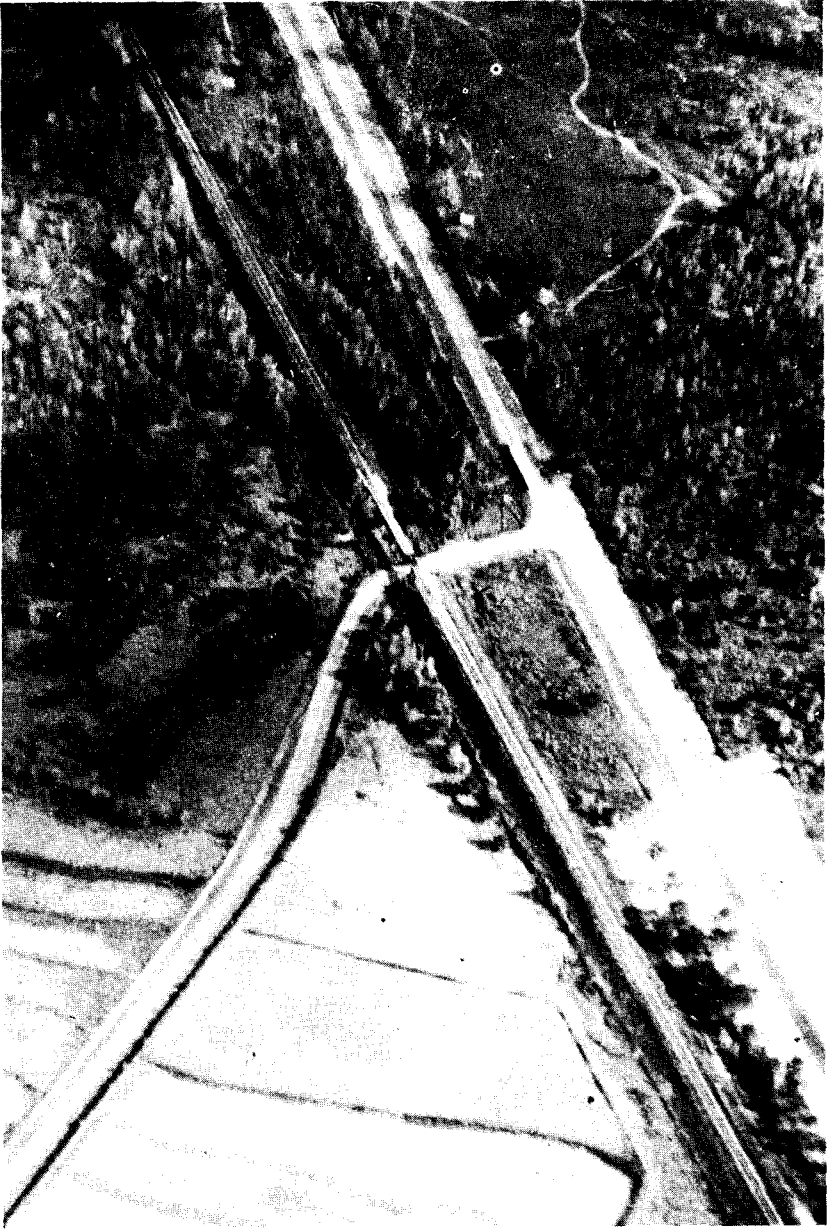


Figure 33. Geographical orientation slide for grid 3-D, map F; photographed from 315° at 2,000 feet.



Figure 34. Geographical orientation slide for grid 3-D, map F; photographed from 315° at 1,100 feet.

the left margin is marked 1, 2, 3, etc., downward, all of which are in grid square increments. The initial orientation is given the student by stating, "Look in grid square _____ (A3, B6, etc.) for the _____ (terrain feature)."

b. Inflight Training. Prior to flight, the aerial observer is given a map (fig. 37) and two grease pencils, and is then briefed on his job requirement, including the method to be used in marking his map. Upon arrival over the grid square designated, the aviator insures that altitude is stabilized at 50 to 100 feet (depending on terrain and airspeed) and alerts the observer that he is over a specified area. He then flies the prescribed flight course without giving any further assistance to the observer. Upon completing the first flight over the course, the aviator may replace the grease pencil with one of a different color to enable the observer to correct his inaccuracies. The remainder of the flight then becomes the critique.

c. Critique.

- (1) The observer is flown back over the course at an altitude of 200 to 500 feet and the terrain features (which are randomly numbered) are pointed out by stating, "Number _____ coming up on the left, number _____ coming



Figure 35. Geographical orientation slide for grid 3-D, map F; photographed from 315° at 200 feet.

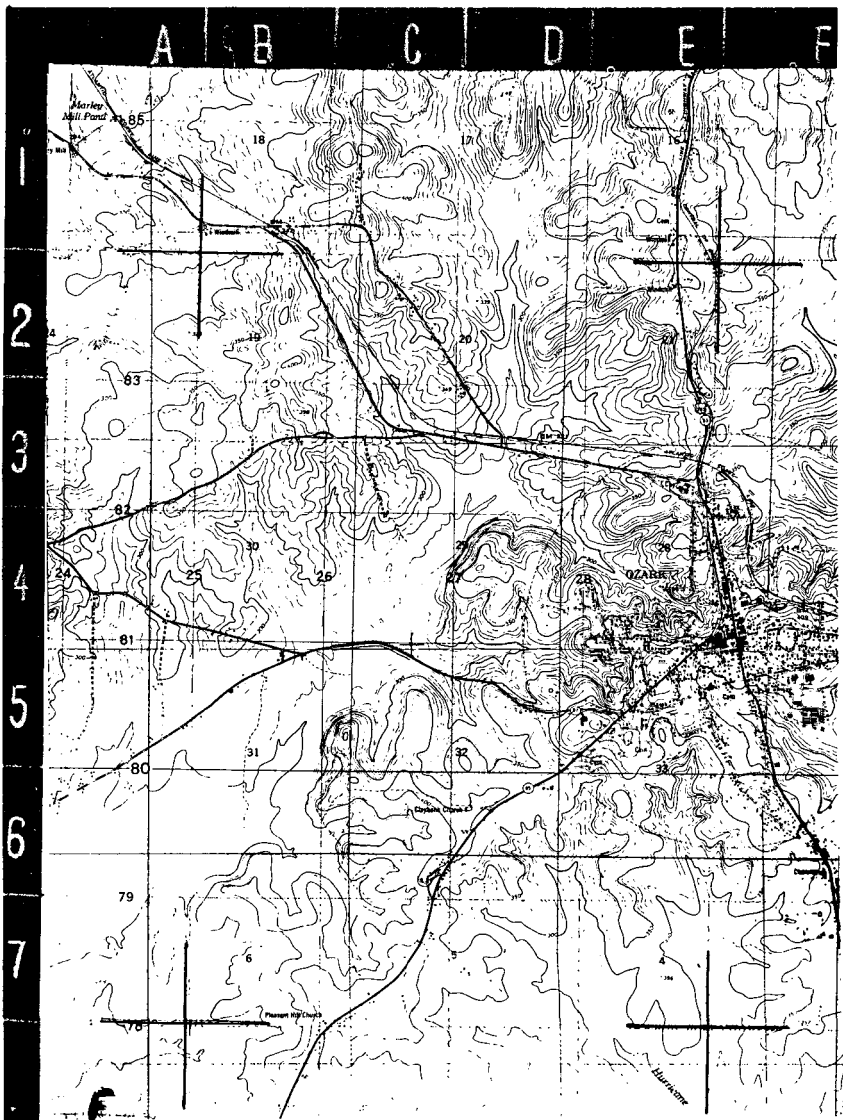


Figure 36. Map F, used in geographical orientation training.

up on the right," etc. With a different colored pencil, the observer may then remark his flight course.

- (2) Upon returning to the airfield, the aerial observer should be critiqued on his flight course and a comparison made on the variance in colored arrows (which should trace the flight course) on his map and the master flight diagram.

Note. Figure 37 is a master flight diagram. The student's map will show terrain features without a flight path.

8. Guide for Development of Training Material

Materials used are an observation helicopter, 35-mm camera and color film, tactical maps scale 1:25,000 or 1:50,000, and compass rose (fig. 38).

a. *Description of Geographical Orientation Features.* Geographical orientation features which should be used for training will vary from one area to another. The unit should use features which will best represent actual or anticipated operational area requirements.

b. *Selection Factors.* Terrain features selected for use in training should meet the following qualifications:

- (1) *Uniqueness of identity.* This means that a feature, such as a road junction, is so laid out that it is not readily

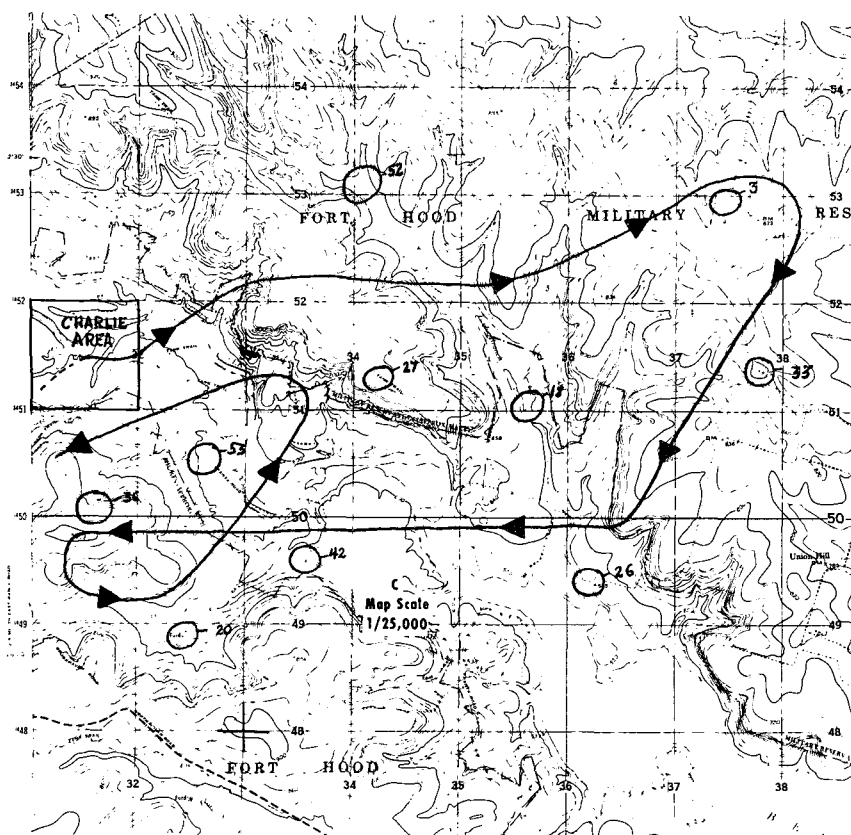


Figure 37. Type course for geographical orientation training, target area C.

confused with a feature of the same sort in the near vicinity.

- (2) *Permanent or semipermanent objects (natural or man-made)*. A house on a road would be a poor selection because of the lack of permanency. A bridge over a river may be destroyed; however, the road approaches and bridge abutments would indicate that the bridge was once there. Use terrain features which will not markedly change by enemy action or time.
- (3) *The twosome rule*. This rule states that a single feature is not sufficient for ready identification of that feature when compared to a map or chart. A river may be a terrain feature, but it is a poor selection unless it is associated with a bridge, a roadway curve, a railroad, or a community. The rule holds true for a road junction, which should be accompanied by a group of buildings (possibly indicated by foundations or rubble), a creek, or a railroad. For orientation training, always associate a second feature with the primary feature to be used.

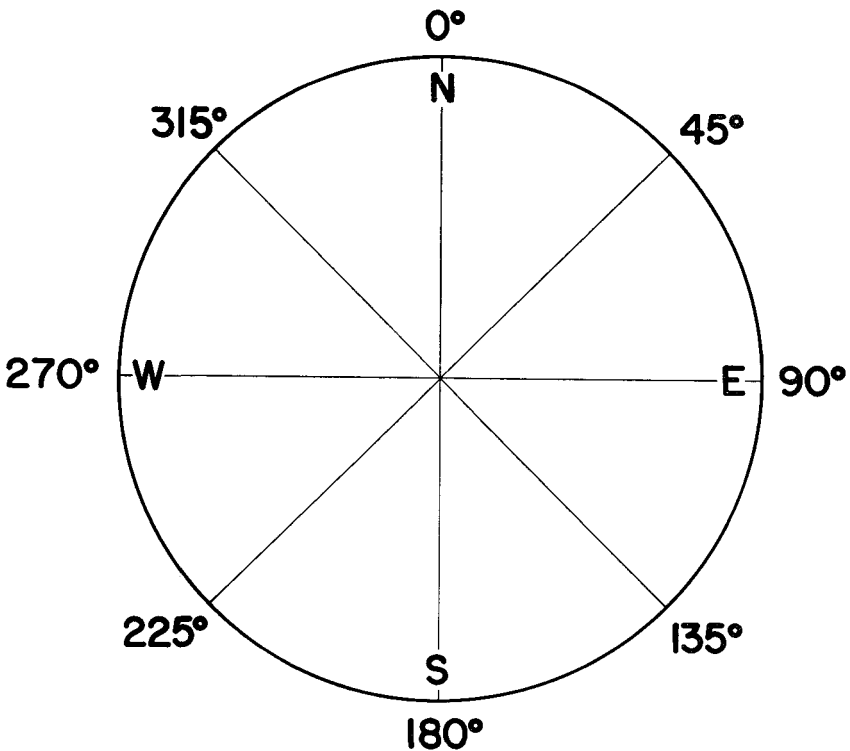


Figure 38. Compass rose.

c. *Method of Development.* Four steps are required for the development of film material. These are—

- (1) *Detailed map study.* For selection of terrain features to use.
- (2) *Aerial inspection.* To be performed on each location to verify map accuracy.
- (3) *Preplanning.* Upon final selection of the terrain features, the aviator and photographer, along with the instructor, preselect the specific points over which the photographs will be taken and mark them on a map for inflight use.
- (4) *Photography.* The simplest method is to fly the highest altitude (2,000 feet actual) over the preselected points, then repeat at 1,000 feet and again at 100 to 200 feet (35-mm camera, normal focal length, color film). The photograph should be taken on the following headings from the target: 0° north, and each succeeding 45° increment around the compass. Each compass heading will be repeated (except where not feasible due to masking effects of terrain) at each altitude. Range will be varied to complete the required number of slides (*e* below).

d. *Film Library.* Selection for inclusion of the training slides should be based on—

- (1) *Picture quality.* Poor quality photographs should be discarded.
- (2) *Variations of altitude and compass headings.* When compiled into a training series, random selection of headings and altitudes should occur for all terrain locations. One example of random selection is as follows:

Slide No.	Photographed from	Altitude
1	180°	2,000 ft.
2	225	200
3	000	1,000
4	270	200
etc.	etc.	etc.

- (3) *The map used in flight (c(1) above).* This will be of value in retaking and supplementing photographs of a particular terrain feature.

e. *Film Requirement.* Approximately 20 slides per location are desirable. A total of 280 slides are required, any portion of which may be used as a test. The first training period will consist of two terrain features; the second through fourth periods will consist of four terrain features. Each feature will consist of 10 slides at 100

to 200 feet and 5 each from 1,000 to 2,000 feet, all of which should give varied compass coverage of the terrain feature. Examples of pictures are shown in figures 27 through 35.

f. Map Folders. The map folder (fig. 36) is constructed by placing a piece of acetate over a stiff backing and then taping on three sides. The grid numbering and lettering system is printed on the top and side. Four grid alignment crosses are superimposed on the acetate to enable quick alignment of the map inserted. Subsequent maps needed are prefolded to fit the folder and are numbered. The student, on request, will insert the map needed for subsequent training sessions.

g. Worksheet. A sample geographical orientation training worksheet is shown in figure 39.

Section V. TARGET LOCATION

9. Guide for Presentation of Target Location Training

a. Classroom Training.

- (1) The aerial observers are shown two colored slides in sequence for each target location. The first slide is a geographical orientation feature which is of the same type shown in his preceding training except that altitude for target location is held constant at 100 to 200 feet. The second picture showing the target viewed is 90° to the right or left of the flight path to the geographical orientation feature. Both slides are taken over the same ground point and at the same altitude. In all cases a large vehicle, such as a 5-ton truck, should be used as the target to be located. Figures 40 through 51 illustrate the type slides to be used.
- (2) Classroom procedures are a combination of those in geographical orientation and the additional procedures required in target location. The steps are as follows:
 - (a) Tell the students what grid square of the map (fig. 52) to look in.
 - (b) Project the geographical orientation slide on the screen and have the observers identify the direction from which it is viewed.
 - (c) Have an observer respond with direction.
 - (d) State that the terrain feature shown is directly ahead of the aircraft's position and the aircraft is flying toward it. This would be a view that the aviator of an L-19 or the aviator and observer in an observation helicopter might see.

NAME _____ RANK _____ SERIAL NO. _____

ORGANIZATION _____

SESSION NO. 0- _____

DATE _____

SLIDE NO.	DEGREES	SLIDE NO.	DEGREES	SLIDE NO.	DEGREES
1		15	.....	29	.....
2		16	.....	30	.....
3		17	.....	31	.....
4		18	.....	32	.....
5		19	.....	33	.....
6		20	.....	34	.....
7		21	.....	35	.....
8		22	.....	36	.....
9		23	.....	37	.....
10		24	.....	38	.....
11		25	.....	39	.....
12		26	.....	40	.....
13		27	.....		.....
14		28	.....		.....

Figure 39. Geographical orientation training worksheet.



Figure 40. Initial orientation slide, map 4, grid 4-B, viewed from 090°.

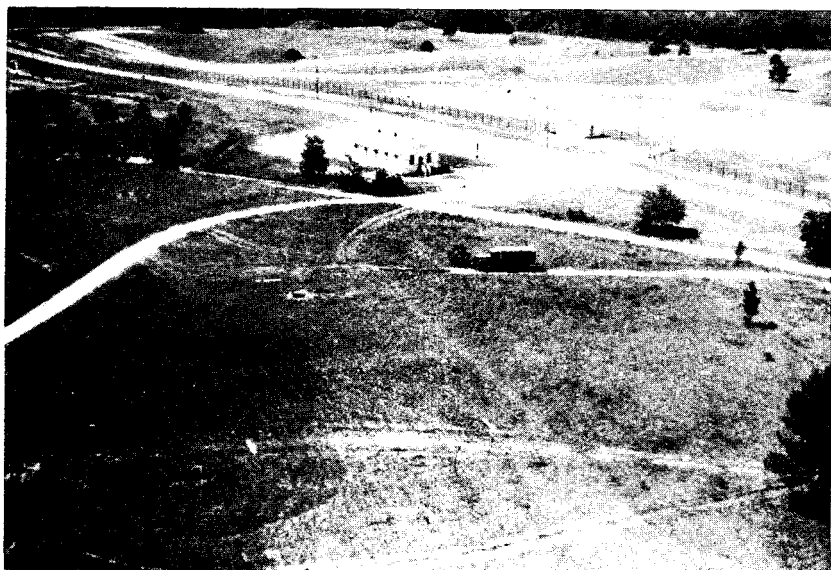


Figure 41. Target location slide looking left.



Figure 42. Initial orientation slide, map 4, grid 4-B, viewed from 090°.



Figure 43. Target location slide, grid 4-B, looking left.

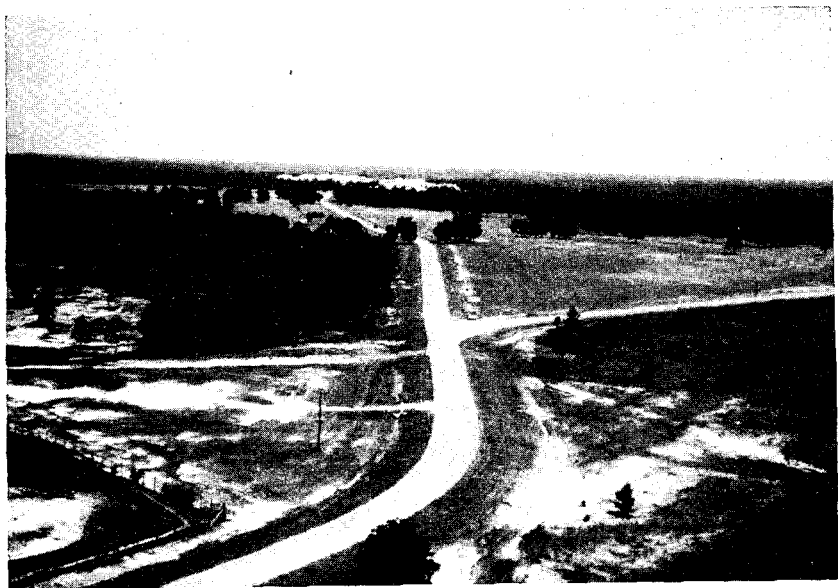


Figure 44. Initial orientation slide, map 4, grid 4-B, viewed from 135°.

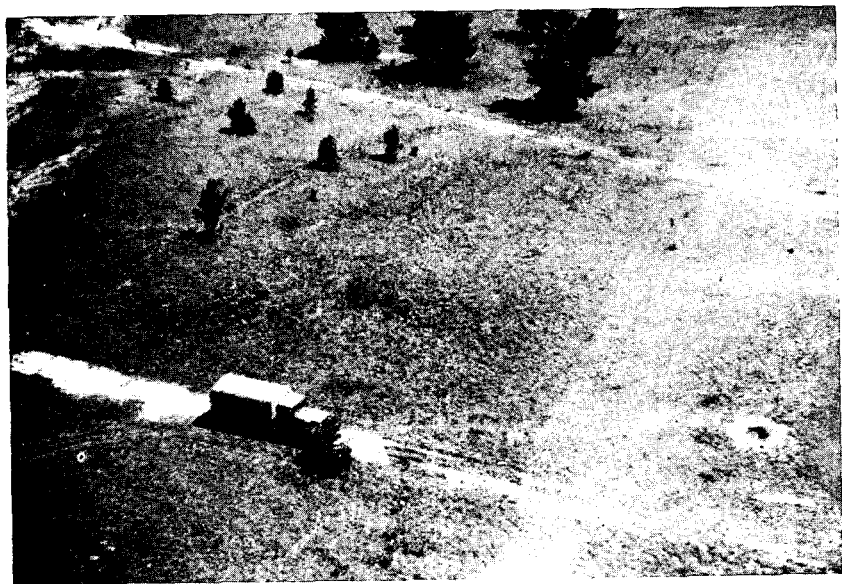


Figure 45. Target location slide looking right.



Figure 46. Initial orientation slide, map 4, grid 4-B, viewed from 135°.

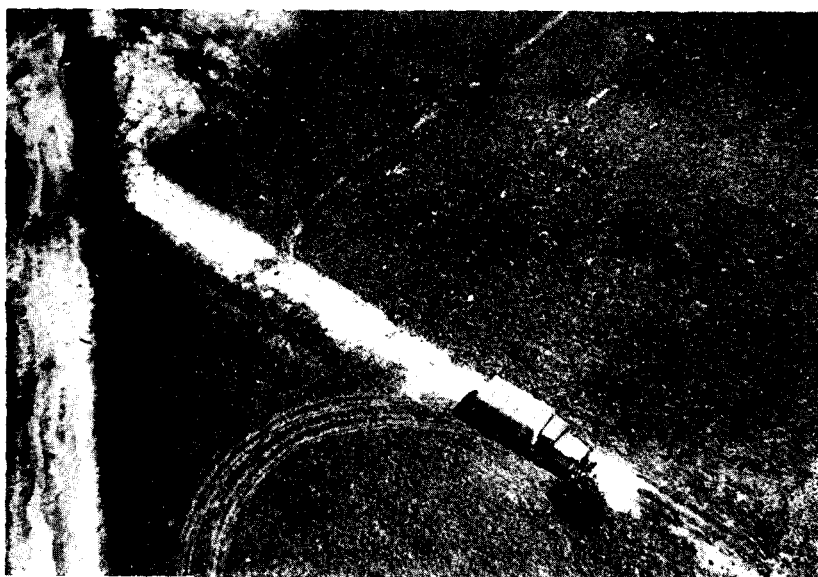


Figure 47. Target location slide looking right.



Figure 48. Initial orientation slide, map 4, grid 4-B, viewed from 090°.



Figure 49. Target location slide, grid 4-B, looking left.



Figure 50. Initial orientation slide, map 4, grid 4-B, viewed from 090°.



Figure 51. Target location slide looking left.

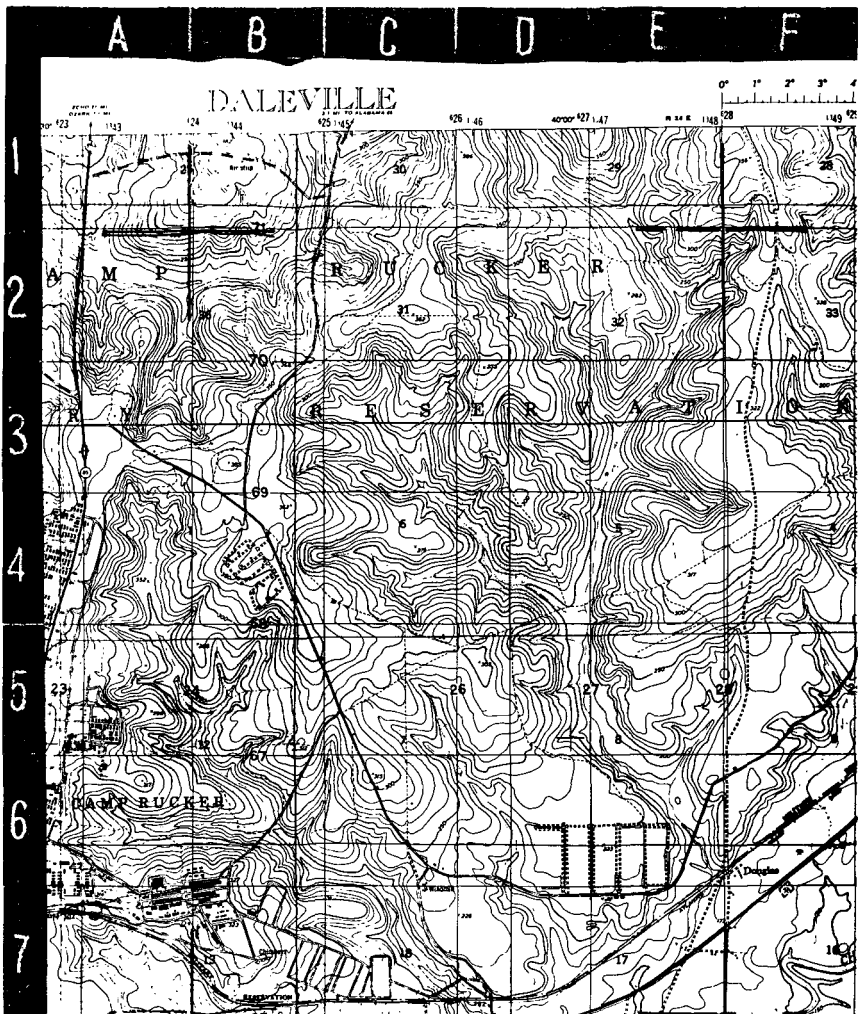


Figure 52. Map 4 for target location training.

- (e) Direct their attention right or left from the flight path (whichever direction is correct for the location slide).
- (f) Project the target location slide.
- (g) Have the observer circle on the answer sheet (fig. 53) the grid location of the target.
- (h) Critique by giving the correct answer on the grid board (fig. 54).

b. Accuracy. The instructor must insure that the location given in the critique is extremely accurate because the goal for training is to enable the aerial observer in flight to position a target on his

map within a 50 meter radius. For multiple targets, the 50 meter radius should be the center of mass of the group.

c. *Grid Board (fig. 54)*. The instructor uses the grid board to assist in critiquing the students. The board should be sufficiently large so that all students may readily identify the subsquares. The board is divided into 16 squares, to simplify the job of locating the targets. Letters or numbers may be assigned the squares so that

NAME Doe, John J. RANK 2/Lt SERIAL NO. 0-00000
 ORGANIZATION 2nd Bn 20th Ber
 SESSION NO. L-1 DATE _____

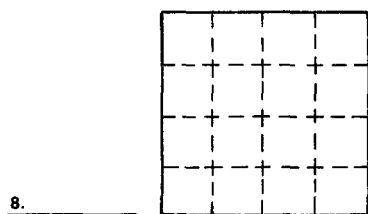
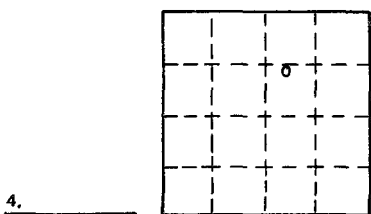
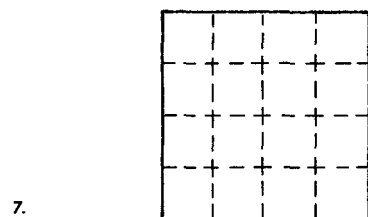
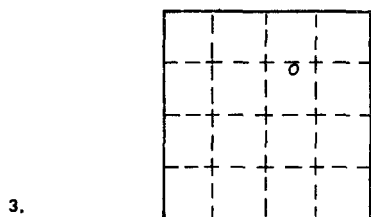
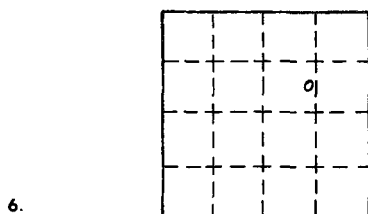
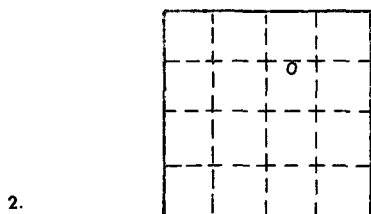
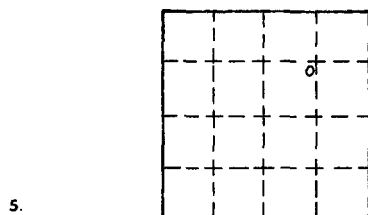
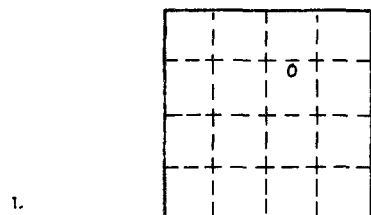


Figure 53. Location training worksheet (filled in).

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

Figure 54. Grid board used for critique in target location training.

student response will be directed to an area 250 meters square. Target location is further defined by having the observer explain where the target is in the square (e.g., upper left corner, upper middle, etc.). Using this procedure, the accuracy of the response can be narrowed to 50 meters.

d. Inflight Practice.

- (1) The following guidance is applicable to target location inflight practice:
 - (a) Aviator training.
 - (b) Controlled terrain.
 - (c) Recording procedures.
 - (d) Aviator procedures.
 - (e) Critique.
- (2) Additional requirements for inflight practice are ground and target conditions. Target conditions for target loca-

tion training should be similar to target recognition training. To enable the instructor to evaluate the student's progress, all targets used in target location training must be engineer-surveyed into location. A survey error of 10 meters in actual ground location is allowed. Type target courses are shown in figures 55 and 56.

- (3) Prior to flight, the observer is handed an acetate-covered map (or strip map) showing the flight path and the initial point. He is then briefed by the instructor on his mission which is to "search for, identify, and locate all targets within the area prescribed." He is handed two grease pencils and told to circle the target locations on his map. Inflight procedures discussed for other phases of aerial observer training apply for target location training.

e. Critique. One method for inflight critique is to request the observer to pass to the aviator the grease pencils after completing the target location flight. The observer is then handed an acetate overlay which shows the surveyed locations of the targets by a dot (center of target mass), a circle surrounding the dot, and the target number. The course is then re flown so that the observer can see where errors occurred.

10. Guide for Development of Training Material

Materials and equipment used are an observation helicopter, 35-mm camera and color film, 5-ton truck (or other large vehicle), and tactical map of local airfield.

a. Selection Factors. Terrain selection criteria established for geographical orientation (par. 8b) apply to target location, except that geographical heading is not considered. After selecting a point over which to photograph the geographical orientation feature, verify its suitability by looking 90° right or left of the inbound flight path to the geographical feature. In the areas right or left of the flight path, there must be a suitably clear location in which to position the target (e.g., 5-ton truck). If a good target site does not exist, continue to shift the proposed photographic point until the geographical orientation feature and target location area are compatible. The target does not appear on the geographical orientation slide.

b. Method of Development of Film Material. Four steps are required for the development of the film material. These are—

- (1) *Detailed map study.* For selection of terrain features to include sufficiently clear areas in which to position the target.

- (2) *Aerial inspection.* Of each location, to ascertain the accuracy of the map and the suitability of the area.
- (3) *Preplanning.* Upon final selection of the terrain features and positions, the aviator, the photographer, and the instructor preselect the specific points over which the photographs will be taken and mark them on a map for inflight use.
- (4) *Photography.* A method by which the photographs may be taken is as follows :
 - (a) Position the target in the target location area.
 - (b) Fly 45° to the geographical orientation feature so that your flight path will take you directly over the photographic point. If weather conditions and safety warrant, the helicopter is brought to zero airspeed while the picture is taken of the geographical feature, and a pedal turn made so the photographer may take the second picture 90° to the first. This procedure insures that both pictures are taken over the same ground point. If weather or safety does not permit zero air-

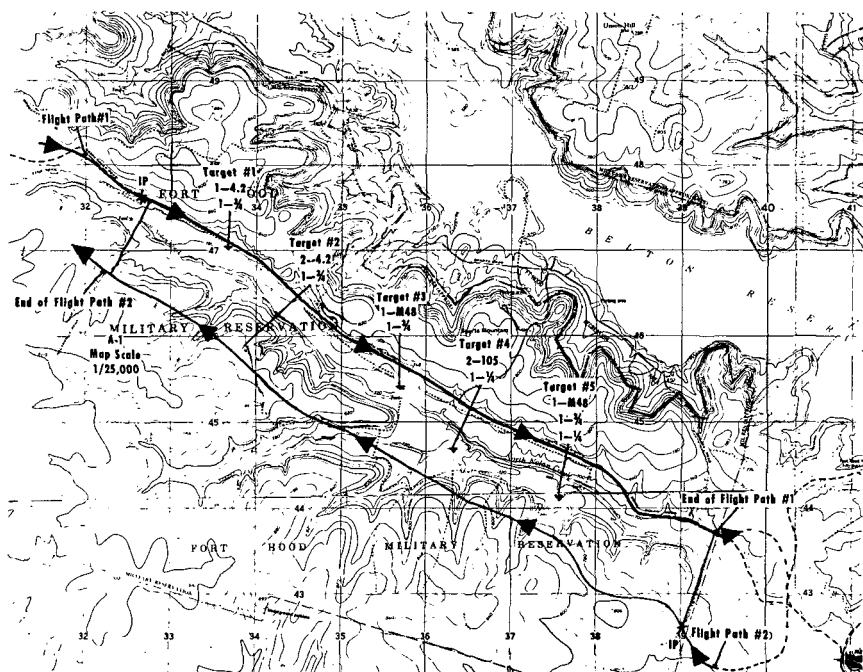


Figure 55. Type target course for target location training (engineer surveyed locations), target area A-1.

speed at 100 to 200 feet, the helicopter may be flown at a safe slow airspeed over the photographic point. The aircraft should then be reflown over the same precise point at the same altitude where the second picture is taken of the target. Range to the target may vary from 100 to 900 meters (table I of text).

c. Film Library Selection. Selection of slides for training should be based on—

- (1) *Picture quality.* Poor quality photographs should be discarded.
- (2) *Suitability of the photographs to fulfill the target location requirement.* More than one picture may be taken using the same geographical orientation feature and the

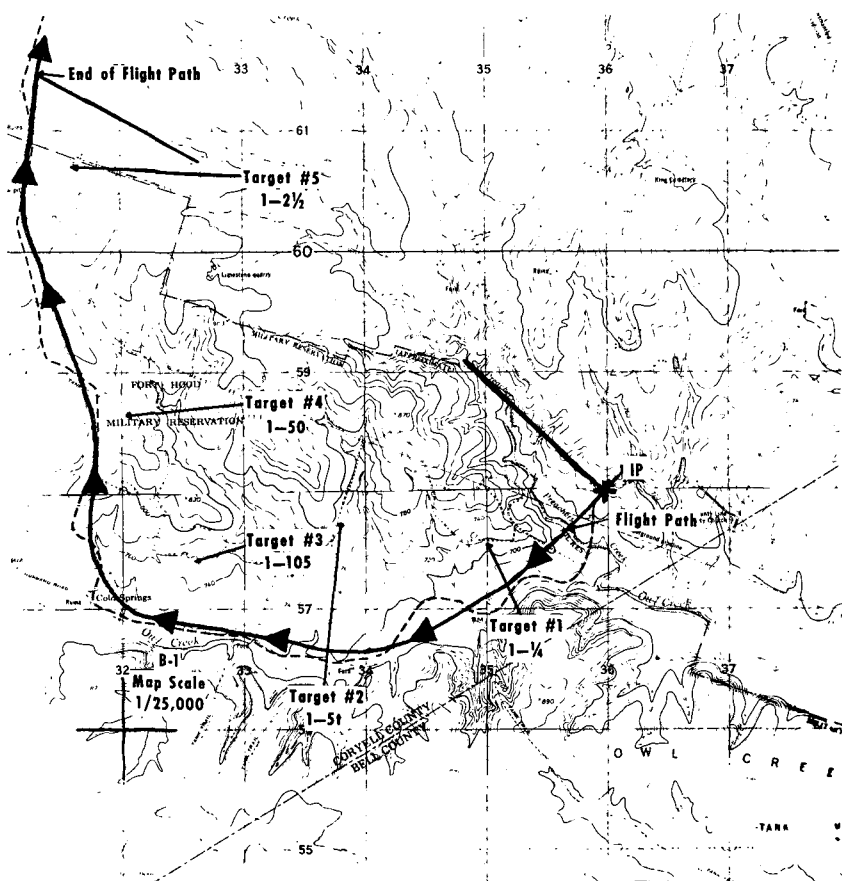


Figure 56. Type target course for target location training (engineer surveyed locations), target area B-1.

same inbound flight path, by shifting the target to another site away from the first. The map mentioned in *b* (3) above will be of assistance in retaking or supplementing any of the photographs of a particular target location.

d. Map Folder. The map folder used in target location training is the same as that used in geographical orientation training.

e. Grid Board (fig. 54). The grid board used in classroom training is a duplicate of the box shown on the target location answer sheet (fig. 57). For most classroom training this board should be 2 feet square. A small movable circle with a scale of 50 meters may be used by the instructor to show the correct answer on the grid board. The board may be constructed out of metal sheeting with a small magnet on the circle or of acetate-covered poster board with the circle backed by tape for adhesion to the acetate.

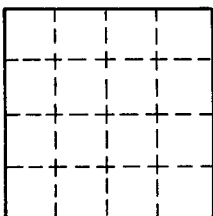
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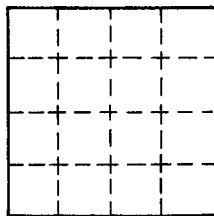
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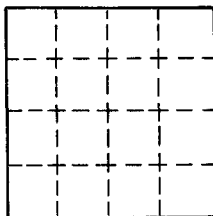
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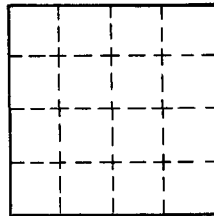
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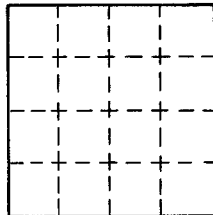
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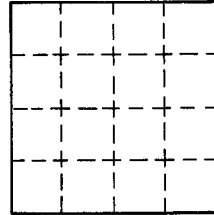
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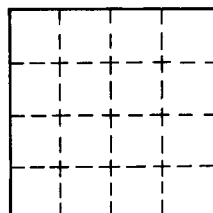
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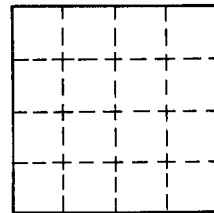


Figure 57. Location training worksheet.

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NG: State AG (3) ; units—same as Active Army except allowance is one copy to each unit.

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For explanation of abbreviations used, see AR 320-50.